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Notes on the Pioche Mining District, Nevada

Operations in the Past Were Generally Unsuccessful Owing to High Cost of Treating the Ores. Renewed Activity Expected

BY S. F. SHAW*

The historic mining town of Pioche is situated in the Ely Mining district, Lincoln county, Nev. It is the county seat and has a population at present of about 1500. The surrounding camps will probably swell this to 2000.

The locust trees lining the streets give the town a rather pleasant appearance. The climate in summer is not uncomfortable and the winter months are not severe, although there are frequent snow-falls.

The elevation of Pioche proper is about 5800, while the adjacent hills rise 600 ft. above the town.

There is no timber worth mention, the only growth being a species of scrub pine. The water supply for the town and mines is piped from springs in the Highland range, about 7 miles to the southwest. The town lies in the Pioche mountains, a range extending in a southeast-northwest direction about 15 miles with an average width of 1 mile, lying between Duck valley on the north and Meadow valley on the south. Mt. Ely is the highest point, reaching an elevation of about 7150 ft. To the northwest lies the Ely range, to the southwest the Highland range, and to the northeast and southeast lie respectively the Cedar and Mormon ranges.

MINES ON EAST END OF MEADOW VALLEY VEIN

140 Miles from Railroad Till 1905

Until 1905 the nearest railroad station was Milford, Utah, 140 miles distant. In that year the Salt Lake road was extended through Caliente, about 28 miles distant, and in 1906 a branch of this road was built north from Caliente to Pioche, placing it 352 miles by rail from Salt Lake City and 485 miles from Los Angeles.

The earliest recorded discovery of mineral was made in 1862 by soldiers under General Conner. In 1863 ore was found by some Mormons, and in 1864 several claims were staked off. It was not until 1868, however, that any important work was done. In that year F. L. A. Pioche employed Charles E. Hoffman to purchase some claims which formed the basis of the Meadow Valley Mining Company, soon afterward organized. Other claims were soon acquired and added to the holdings of the company, giving it a length of about 2500 ft. along the principal vein.

Soon afterward Wm. H. Raymond and John H. Ely entered the camp and organized the Raymond & Ely Mining Company which became the most important producer of the district.

Ores Milled on the Ground

Owing to the remoteness of the district, it became necessary to treat a large part

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of the ore on the ground. Raymond and Ely first installed a second-hand 5-stamp mill at Bullionville, near Panaca, and treated the crushed ore by amalgamation in pans and settlers. These stamps weighed 750 lb. per head and treated a total of 25 tons daily at a cost of $30 per ton, netting a profit of $90 per ton. Three large mills were built at Bullionville.

In 1872 a narrow-gage railroad was built to Bullionville reducing greatly the cost of transportation. About the same time the Meadow Valley company erected a 20-stamp mill at Dry Valley, about 10 miles east of Pioche, introducing the Washoe process then in use on the Comstock lode. The erection of other stamp mills followed.

Other processes besides amalgamation were also tried at later dates. Lixiviation was employed to some extent. At Bristol, about 20 miles northwest, a smeltery was built to treat the ores of that camp. All of these operations meant much to the district and the population of Pioche approached the 10,000 mark.

Renewed Activity Expected

In 1875-76 as depth was reached, the ores became impoverished. In the Meadow Valley shaft No. 3 water was struck at a depth of 1314 ft. on the incline, and the pumping problem became a serious one as further depth was attempted. In 1876 the failure of the Bank of California shut off all funds for further development work and the principal mines suspended operations.

In 1890 work was resumed, a narrow-gage railroad to Jackrabbit was built, a smeltery erected and Pioche once more began to assume the role of an important mining camp. However, the work done did not meet with the anticipated results and, with the decline of the price of silver in 1893, it again took on the appearance of a deserted camp.

In 1906, new capital became interested in the camp, and development at Jackrabbit, and also in the limestone on the south side of the town, is giving encouraging results. A railroad from Pioche to the south side is projected, and some rumors are heard of a smeltery to be built soon.

Production, Past and Present

The gross production of the properties in the district has been variously estimated at from $16,000,000 to $40,000,000. Probably $25,000,000 would cover the total production to the present time of those properties situated in Pioche and the immediate neighborhood. The mines along the porphyry dike are said to have yielded about $5,000,000, although no reliable figures touching on the distribution of this production are at hand. In the *Sch. Mines Quar.*, July, 1906, tables are given by Prof. Fred J. Pack, which were taken from the Daily Stock Report Assessment List, San Francisco, Jan. 7, 1876. From these tables it is seen that only two companies had, until 1876, paid an excess of dividends over the amount of assessments levied, and this amount, $2,475,000, is about 18 per cent. of the the gross production of these two companies. The total production until 1876 was $15,485,500. Dividends amounting to $4,385,000 had been paid, and $5,482,900 assessments levied.

During the early years of the camp the cost of mining and milling was high and the extraction low, hence it is not to be assumed that the same grade of ore, or for that matter a much lower grade, would not now yield a profit. An accompanying table, also given by Professor Pack, will show the high costs that prevailed in 1870-1876.

In 1875 the average yield of the Raymond & Ely ores was $52.36 at a cost of $45.10 for extraction, treatment, etc.

At the present time the Nevada-Utah Mines and Smelter Corporation is shipping about 150 tons of low-grade fluxing ore from Jackrabbit, averaging about $10 per ton. The Prince, on the south side, and the Mendha, about 6 miles southwest of town, are also making small shipments. The Prince is prepared to ship a largely increased tonnage as soon as the railroad is extended to that side of the range.

Geology

The Pioche mountains consist of an anticlinal fold with its axis extending from east to west, the strata of which consist of an underlying layer of Cambrian quartzite covered by a layer of shale about 400 ft. thick, which, in turn, is overlaid by a layer of limestone about 1400 ft. in thickness. A thin layer of shale of varying thickness is also noted in the limestone. The thickness of the quartzite is unknown, but it cannot be less than 1500 ft., as the Raymond & Ely shaft penetrates it for that distance.

Just south of the town the quartzite has been thrust up between two parallel faults, bringing it into juxtaposition with the shale on the north and south. It towers several hundred feet above the shale which dips away to the southwest from the central quartzite core at an angle of about 35 deg. It is in this upthrust block of quartzite that the Raymond & Ely-Meadow Valley vein, containing the rich orebodies, was first discovered.

WEST END OF MEADOW VALLEY VEIN

PIOCHE KING MINE

Dikes an Important Feature

After the faulting which raised the quartzite to its present position took place, there followed an intrusion of a quartz-rhyolite dike averaging about 75 ft. in thickness. This dike, generally known as the Yuba, strikes approximately magnetic east and west, cutting through all the sedimentary strata and dipping about 80 deg. to the south. In the neighborhood of the Yuba East mine this dike splits, one branch extending in a southeasterly direction, the other disappearing from sight. At the Alps mine, about 1 mile east, a porphyry dike is cut in the lower workings, and, as the shaft is in line with the northeast branch of the dike, this is supposed to be its continuation.

In a westerly direction it continues

through the Yuba East, Yuba, Currency and Mazeppa, and then splits again. One branch comes up through the shale and lime and runs lengthwise through the Alberta claim of the Ohio Kentucky company. The other continues westerly through the Raymond & Ely ground constituting the Independent vein (owned jointly by the Nevada-Utah and Ohio Kentucky companies). This latter fork is found only in the quartzite, not coming to surface through the shale and lime.

A dike of the same character is encountered in the Abe Lincoln tunnel about 2 miles southwest, and in the West Yuba and Fargo claims in the lower divide about 4 miles west of Pioche. There are also outcrops of an igneous nature at intervals both on this and on the other side of Stampede gap, and, as they are all said to line up with the Yuba dike, they are thought to be along the same intrusion.

In nearly all of the outcrops the component minerals of the dike are much decomposed with the exception of the original quartz crystals, which remain unaltered. The decomposition is also found to extend to the deepest workings. However, undecomposed material is encountered in the Abe Lincoln tunnel, and on the 800-ft. level of the Yuba East fresh specimens of a reddish appearance and showing large quartz phenocrysts have been taken out.

In some of the Yuba East workings the decomposed dike material is found to have minute pyrite crystals disseminated through it. In this mine the dike is broken up into an extensive series of transverse fractures which, from observations so far made, could be explained by contraction fractures formed during the cooling of the intrusion. On both walls of the dike movement has taken place, leaving behind a clayey gouge parting between the dike and the quartzite.

Fissures in the Quartzite

The quartzite is broken up into blocks by a series of fissures and cross-fractures. The Raymond & Ely-Meadow Valley ore deposits were found in the largest of these fissures so far discovered. This vein strikes east and west and dips about 70 deg. to the south, and maintains an average width of 2 to 4 ft., narrowing down in places to a mere seam, and widening out in others to 9 or 10 feet.

This vein, being less inclined than the Yuba dike, approaches it in depth, and if the same inclination were maintained throughout would meet the dike at a depth of about 1500 ft. The strike also being different causes the vein to intersect the dike west of the Lightner shaft.

The vein can be traced from its approximate intersection with the dike for a distance of 1300 ft. to the east where it divides into two branches at an angle of about 20 deg. to each other. The northeast branch extends about 1000 ft. to the Pioche shaft, a short distance beyond which it again branches and breaks up. The southeast branch continues beyond the Burke shaft, where it soon loses it identity.

The sequence of events as given by Professor Pack is as follows: (1) Anticlinal movement and shearing; (2) deposition of the bedded deposits; (3) breaking down of the anticlinal fold; (4) intrusion of the Yuba dike; (5) deposition of fissure veins and deposition on the dike contact; (6) minor cross-fissuring.

The Mines on the Quartzite Fissure.

Along the quartzite fissure the principal mines are the Hermes, Raymond & Ely, Meadow Valley No. 3, Meadow Valley No. 5 and Pioche. Also the Washington and Creole and Burke shafts which are located on the southeast branch of this fissure.

The Lightner shaft of the Raymond & Ely mine was started in the shale, and, on sinking a distance of about 100 ft., struck the large Raymond-Ely "bonanza" out of which the greater part of the ore was extracted. This body was about 400 ft. long at the 5th level, was almost continuous from the surface to the 8th level and varied in width from 1 to 4 ft. Below the 8th level the grade of ore deteriorated. At a depth of 1214 ft. the Lightner shaft encountered the water level and was compelled to install a 10-in. Cornish pump in order to reach greater depth. This level was extended west about 2100 ft., and at a point about 1400 ft. west of the shaft a winze 300 ft. in depth was sunk on the "black ledge," opening up a large body of lead and zinc sulphides. This vein is the westerly continuation of the north branch of the Yuba porphyry dike, the best streak being found on the north contact of the porphyry and quartzite.

The Meadow Valley No. 3 was sunk 1314 ft. on the incline before the water level was reached and was then continued to 1375 ft., at which point sinking operations were discontinued on account of the shutting down of the Raymond & Ely pumps which had previously drained the Meadow Valley. Considerable low-grade ore was encountered below the water level, the grade seeming to increase with depth.

The Burke mine was the first located and its vein was followed from the surface to a depth of about 300 ft. The vein in nearly all of the mines continued strong at depth but the orebodies became too greatly impoverished to work. Shafts were also sunk on cross-fissures extending between the main fissure and the dike, among the principal ones being the Williams, Desdemona, Huhn & Hunt, Chapman, and Arkansas.

Mines on the Dike.

The principal mines along the Yuba dike are the Newark, Mazeppa, Currency, Yuba, Yuba East, and Alps. The Williams mine, mentioned as being on a cross-fissure, contains the south branch of this dike. The ores occur on both hanging- and footwalls of the dike, and also along what is known as the "middle vein," which is really a set of fractures paralleling the strike and lying wholly within the dike.

The Yuba mine workings reach a depth of 1300 ft. and consist of about 2700 ft. of shafts and raises, and 7500 ft. of drifts, making a total of about 10,200 ft. The ore extracted from this mine is said to have approximated $1,000,000.

In the Yuba East, immediately adjoining the Yuba on the east and connected with it by a drift on the 100-ft. level, about 1400 ft. of shafts and raises and 3500 ft. of drifts have been made. The depth of the shaft on the incline is 840 feet.

Mines on the Bedded Deposits.

The principal mines working on the bedded deposits are the Prince, Mendha, Abe Lincoln-Half Moon, Point and Ely Valley properties. The Pioche King, Golden Prince, Gold and Silver Prince and Demijohn are also properties exploiting these bedded deposits.

The Prince mine is about 3 miles south of Pioche on the Meadow Valley side of the Pioche range. The shaft has reached a depth of about 600 ft. on an incline of about 65 deg., and about 6000 ft. of drifting, crosscutting and raising has been done, opening up the beds and veins in a systematic manner for a distance of 600 ft. on both the north and south sides of the shaft. The entire workings are in shale and limestone, the beds of which strike about north and south and dip about 15 deg. to the east.

Here the bedded ore deposits replacing the lime were dislocated by a series of fractures into a system of step faults. This faulting was followed by a system of faulting producing a set of vertical fissures, two of which have been explored,

COST PER TON FOR MINING.

Year.	Company.	Extracting.	Prospecting and Deadwork.	Incidentals.	Total.
1871	Meadow Valley	$14.20	$5.71	$4.59	$24.50
1872	Meadow Valley	.....	.....	.....	38.55
1872	Raymond & Ely	.....	.....	.....	14.45
1873	Raymond & Ely	13.67	12.19	5.97	31.83
1874	Raymond & Ely	23.06	50.06	6.13	79.25
1874	Meadow Valley	22.19	48.87	.....	71.06
1875	Raymond & Ely	14.78	20.18	10.14	45.10

crossing the bed faults at an angle and breaking them up into a regular system of fault blocks. A series of cross-fractures can also be distinguished running between the two vertical fissures. The bedding planes, vertical fissures and cross-fractures all make ore composed of galena, anglesite, and cerussite, rich in silver and carrying some gold.

The shaft was first started on an immense body of low-grade manganiferous ore containing about 6 per cent. lead and 6 oz. silver. As depth was reached this body was found to run into and follow the bedded deposits. The vertical fissures were first discovered on the third level, and when followed upward were found to apex in the large body of manganese ore previously mentioned.

The Abe Lincoln-Half Moon workings are also on a bedded vein which lies between the shale and the limestone. The mineralized part is about 12 in. thick. The Yuba dike was encountered in these workings. At the Mendha mine a system of block faulting quite similar to that of the Prince mine is seen, with the bedded ore deposits occurring along the fault planes. The ores of this property contain more gold than is usual in the ores of the other mines.

Treatment of the Ores.

The first attempt in 1871 to treat these ores, then consisting for the most part of silver chloride and sulphide associated with low percentages of lead sulphate and carbonate, was by smelting. Owing to the low lead content the attempt was not a success. Later stamping, followed by amalgamation in pans and settlers, was tried, and on some of the ores gave as high as 60 per cent. extraction, while on other it fell below 40 per cent. The Washoe process was then employed wherein salt and copper sulphate were added to the pulp in the pans, and the extraction rose to 80 per cent. The amalgam so obtained contained a considerable quantity of lead which was separated by first straining through a sack in hot water, the lead passing through with the mercury. The mercury was then retorted from both the products and the lead and silver thus recovered separately. Lixiviation with "hypo" was also tried with more or less success.

At the Half Moon mine a small crushing plant was put in to handle about 50 tons per day. The product was run over tables and the tailings treated in cyanide vats. The extraction was low and the cost of treatment high, but the reason for this is apparent to one comparing this old plant with the cyanide mills of the present day. In 1890 the new smeltery built below Pioche was successful in treating the ores then mined, which contained more lead than formerly. These ores came largely from the Yuba dike and from the mines at Jackrabbit.

At the present time the ore developed consists principally of lead carbonates, sulphates and sulphide, carrying gold and silver. This ore is adapted only to treatment by smelting. Large bodies of ore, low in lead and silver, but containing an excess of iron and lime, have been developed and will provide the flux for handling the higher-grade and more silicious ores. As depth is reached it is quite probable that the ores will run into lead and zinc sulphide.

Wet concentration tests, obtaining a commercial degree of extraction, have yielded lead and zinc products which are said to have been of good grade.

I am indebted to E. L. Godbe for supplying some of the data herein used.

Practical Working of the Stamp Mill

By Algernon Del Mar*

The number of tons of ore crushed by a stamp mill in a given time depends upon the weight of the stamps, the hight of drop, number of drops per minute, hight of screen discharge, size and character of screen openings, the width of mortar at the discharge, the character of the mortar foundations, condition of wearing surfaces of shoes and dies and the number of hours the mill is at work. The last factor will be the subject here treated.

We see in a certain report that the mill has run 93.8 per cent. of the time. If we allow 25 min. a day for two brushings and 1½ hours per battery once a month for clean-ups, this will consume for a 100-stamp mill about 1400 stamp hours per month, or say 2 per cent. of the time, leaving 4.2 per cent. for repairs (3042 stamp hours), an average of four stamps hung up all the time. The idleness of these stamps entails losses besides that in crushing time from expenditures for repairs and wages for at least four men, unless the loss of time is due to causes outside of the mill proper. With a stamp mill as with other classes of work all necessary repairs should be well made. The time lost in doing a good job will in any case be repaid in the gain in running time.

A mill to attain its maximum capacity should be at work all the time except, of course, such time as is actually necessary for keeping the plates in condition for catching the precious metals, for the regular clean-up and for changing shoes about once every six months. This last item does not consume more than 15 min. per stamp twice a year and so is hardly appreciable. The dies need only be changed on clean-up days and it takes no more extra time than setting the tappets. There are many stoppages due to defects in construction and operation which may be lessened by careful and knowing management. Much loss of time is often occasioned by not having duplicate parts handy and by carelessness in making repairs.

Important Details of Construction

Our mills of late years have gained in capacity as well as in running time on account of the greater weight of the stamps used, higher speed, better materials used in construction and improvements in the style of the several parts. There has been a retrogression in the adoption of iron guides of the usual individual cap type. These guides have made repairs more frequent because the stems working in the guides wear so that they become too small for the tappets to be set without shimming and excessive hammering, which destroys the tappet gibs besides wearing the patience of the millman. The play in the guides is often so great that shoes and bosses hit or the shoes wear unevenly on the dies.

It might be argued that worn guides should be immediately changed for new ones, but as a rule they are not and the millman must put up with them and the consequent breakages. Wooden guides are preferable to iron ones and wear for years if properly taken care of. When sectionalized they have given trouble and when in one piece (the cap) they cause loss of time in changing stems or tappets, for the whole battery must be hung up. However, there is no reason why sectional wooden guides fitting in a cast-iron frame should not be satisfactory. The Angelo Camp individual sectional guides are a very good type of iron guides. No bolts are used except for bolting the frame to the guide timbers, and the wearing parts are so inexpensive that there is no excuse for having loose guides. The stem works in a cylindrical casting about ½ in. thick, which castings may be split in two for the lower guides or for a burred (broken) stem in the upper guides. The cylinders fit in a truncated cone-shaped receptacle in the frame so that the cylinders are kept in place by gravity and the vibration of the battery frame. To change a stem or tappet the cylinders are forced up and the stem may then be taken out.

Feeders seldom cause loss of time. The expense and trouble due to pawl springs, as well as the time lost over a broken stem caused by a feeder not working and the battery running dry, may be obviated by the use of the Knight wheel in place of the usual friction wheel with pawls. This wheel is worked on the leverage system and gives a more constant and

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even feed than the pawl wheels besides causing no trouble or expense.

A mill may lose time from a variety of causes, such as tappets slipping, bull-wheels coming off, cam shaft collars loosening, cams breaking, cam shafts breaking, stems breaking, bosses or shoes coming off, dies becoming misplaced, changing of shoes and dies, breaking of bosses and shoes, changing of screens and other causes due to the personnel of the mill force. The use of self-tightening cams has reduced this cause to a neglectable quantity and when the same idea is generally applied to the bull wheel the trouble caused by loose bull wheels will end.

Tappets, Bosses and Shoes

Tappets slip usually from the stem having worn too small for the gibs to hold. A tappet that does not fit close to the stem binds only on two surfaces, that of the gib and that on a line opposite the center of the gib. Patents have been taken out for tappets with holes bored in other shapes than round in order to give more than two bearing surfaces, but there is no reason for this as with a keyway opposite the gib for the insertion of a key or shim that would fit the stem and jam it against the gib, the keys would hold the gib firmly.

To set a tappet on a worn stem an iron shim must be driven between the stem and the tappet opposite to the gib and the keys driven in with a heavy hammer. This will, no doubt, in a very short time break or otherwise damage the gib, when the tappet must be taken off and replaced. The battery need not be hung up for this purpose. The remedy is a new stem but few mills can afford this luxury. The cause in the first place was probably the iron-cap guide. Some millmen shift the tappets by allowing the cams to do the work instead of driving out the tappet keys and using the chain-blocks. The time saved is a doubtful economy, for the gib wears into the stem and after a few settings the time taken to loosen the gib may more than offset that required to drive the keys in the first place, with no injury to the stem or gib.

Cam shaft collars loosen by the vibration of the cam shaft; the remedy is to line up the cam shaft, thus reducing vibration to a minimum, and not to have the set screws too deep in the shaft or big holes will wear out as soon as the collars loosen. It might be well to have a split collar bolted on like the feed collar, but with two set screws to replace that next the bull wheel, to replace which, in the ordinary way, would mean stripping the shaft of cams.

Steel cams seldom break, the only cause being from a loose tappet pounding on the horns of the cam. The millman should at once set such a tappet. Cam-shafts some times crystallize and break. This is due to vibrations caused by inattention to keeping the shaft lined up, but even if this is carefully attended to, crystallization will often take place even in a 6-in. shaft. Every mill should have an extra shaft available to replace a broken one.

Breakage of Stems

Stems, too, break from crystallization or change of molecular structure due to vibrations caused by pounding on the dies and the lift of the tappet. The breaking seldom occurs but at the two nodes where the stem enters the boss and where it enters the tappet. The uneven wear of shoes and dies, the play in the guides causing blows at an angle to the line of drop and the introduction into the mortar of mine or mill tools, may cause a broken stem. Broken stems should be annealed before being again used to correct any crystallization remaining near the new end. When a battery is hung up, if the stamp that dropped last is allowed to drop first when starting, the jar due to the shoe striking the die may cause a broken stem. It is therefore best to hang up the feed stem first and drop it first. This throws the ore under the feed when hanging up and acts as a cushion on starting.

The quickest way to change a stem is to take off the guide caps and turn it over if the tappet is good on both ends. If the stem is broken on the top end, the tappet must be taken off, put on another stem and this replaced and caps bolted on. The two batteries need be idle only when hoisting out and replacing the stem, so far as this portion of the work is concerned. The battery is hung up, the boss taken out of mortar, shoe forced off and wedged into the extra boss. The boss with shoe on it is then returned to the mortar, the tappet approximately set, the stem stuck in the boss, the shoe pounded on and the battery is ready. The tappet may be set at its proper place at any time. With two men this may be done in half an hour, but if the broken stem must be wedged out of the boss before starting the battery, it may take an hour or more. With the extra boss the broken stem may be forced out at leisure.

Bosses come off because the drop is either too high for the speed, causing "camming," or too low for the style of cam, causing a series of blows which may force the stem out of the boss. If there is too much play in the guides so that the bosses strike, the stem may come out. It may be that the stem has not been turned to fit the boss, in which case it must be carefully shimmed. Some prefer putting on bosses with iron shims but if the stems fit well canvas is to be preferred. Steel bosses are better in every way than the usual ones of cast iron. They do not break so easily and the holes for shoes and stems wear much better.

Shoes come off from too much play in the guides, too much ore in the mortars or from the pounding of the shoe on the die. The fault is generally a personal one. If the shoe is difficult to "stick," roughen the shank with a chisel and use only hard-wood wedges. Dies when worn down to near the discarding point often become misplaced. When the dies were replaced at the previous cleanup they should have been carefully wedged in place.

Treatment of Millmen

Some of the time lost, due to carelessness on the part of the millman, should indirectly be charged to the inconsideration of the management. Miners generally have a change room with hot water and a place to hang wet clothing, but millmen seldom have this luxury. In the coldest weather a stove may be provided, in some far corner of the mill, so who is to blame the millman if the call of nature for warmth is more potent than the call of duty. The 12-hour shift, which has been practically discarded in the West, was also an injustice and the cause of much negligence. Those who have tried 12 hours' work day in and day out without a day off even at Christmas, know how worked out and ambitionless a man becomes. The night shift becomes a drag of the worse description, a fight between sleep and duty. In order to obtain the best results millmen should be treated with consideration and be well taken care of.

Great activity is being shown in the new Coleraine district, Minn., where the Oliver company is opening three mines. At the Canisteo, at Coleraine, the first trainload of iron ore taken out was shipped July 27. At Taconite, about two miles northeast, the first load of ore was shipped May 17 from the Holman mine. An area of ground over one mile long and several hundred yards wide is now being stripped by shovel, preparatory to taking out ore later in the season. At this place a concrete shaft is also being sunk, but this one is to be used as a pumping shaft to drain the large open pit. A drift will be run from the bottom of the shaft under the pit and the mine drained in this way. A large amount of the ore in the Coleraine district is low grade, being mixed with a high percentage of sand. In order to use a portion of this ore, it is necessary to concentrate it. A washer which will have a capacity of 500 tons per hour, is now being installed for this purpose. The power house and pumping station are well under way, while only the foundation piers are in place for the mill.

Silver-Lead Mines of Bawdwin, Shan States

Mines Probably Worked 1000 Years Ago, but First Authentic Record Indicates That Work Began in 1412 A. D. Ancient Chinese Methods

BY T. D. LA TOUCHE * AND J. C. BROWN †

By T. D. La Touche

The existence of rich ores of silver and lead in the northern Shan States has been known for many years. In the accounts of the various missions to the Court of Ava, from that of Michael Symes, in the year 1795, to that of Sir A. Phayre, who was accompanied by Dr. T. Oldham, superintendent of the Geological Survey, in 1855, reference is made to these mines.

A very high antiquity has been ascribed to the Bawdwin mines. C. H. Henniker[1] says that work probably commenced there over 1000 years ago, but gives no authority for the statement. The first authentic record of the mines is found in an inscription, discovered at Bawdwin and translated for Mr. Maclaren, late specialist, Geological Survey of India, by Taw Sein Ko, the Government archæologist, Burma. According to this inscription, work was commenced at Bawdwin by the Chinese in the ninth year of the Emperor Ch'ingtsou (Yonglo) of the Ming dynasty. This date would correspond to 1412 A. D.[2] The first mention of the mines to be found in a European work is by Symes in 1795, who calls the place Badouem, and says that it is six days' journey from Bamoo (Bhamo) near the frontiers of China.[3] Crawford, in 1827, estimated the production of the mines at 960,000 ticals or £120,000 sterling annually, and was informed by two Chinese merchants, who had been to the place, that about 1000 miners were employed and that the tax paid to the King of Ava was 4800 ticals, about £600 sterling. He places the locality, which he calls Bortwang, at 12 days' journey from Bhamo, toward the Chinese frontier.[4]

At about the time of Sir A. Phayre's visit to Ava the Panthay rebellion broke out in Yunnan, and taking advantage of the unsettled state of the country, the Kachins of the northern hills began to advance southward, rendering the position of the Chinese at Bawdwin very precarious. A further cause for the decline of the industry which now took place must have been the increasing difficulty of procuring fuel and supplies and of extracting the ore as the galleries approached the level of the stream flowing through the valley, in the absence of more efficient appliances for dealing with the increasing influx of water than were possessed by the Chinese, and the mines were finally abandoned by them about the year 1868.[5]

After the departure of the Chinese the Burmese Kings, Mindun Min and Thebaw, made several attempts to work the mines, but owing to the ravages of disease and the want of metallurgical knowledge these efforts resulted in failure.

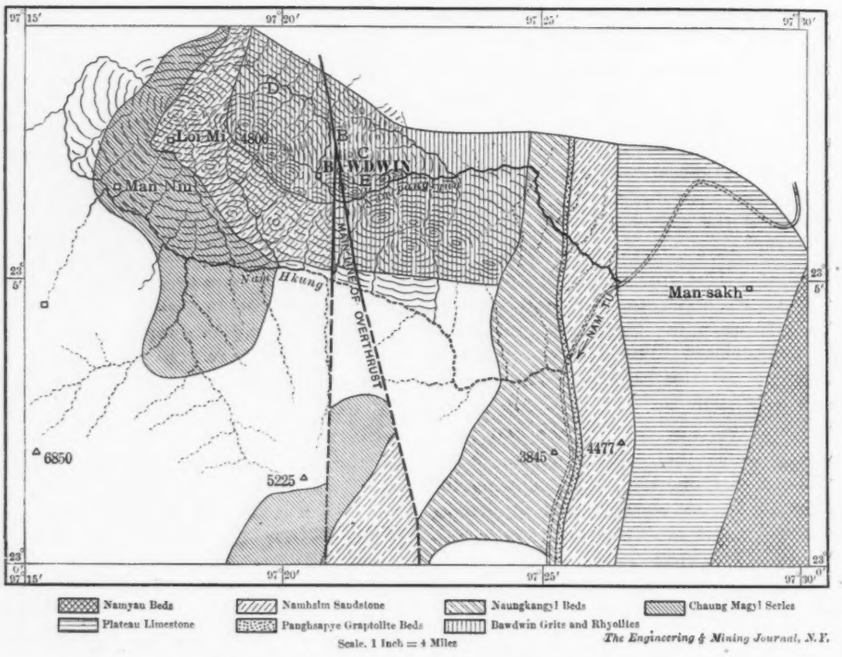

FIG. 1. SKETCH MAP OF THE BAWDWIN DISTRICT

I have been informed by C. A. Freymuth, who was one of the first Europeans to visit the mines on behalf of the syndicate formed to reopen them, that on his arrival he found a number of Kachins employed in smelting portions of the slag heaps left by the Chinese. For this purpose they picked out the richest fragments of slag, containing 50 or more per cent. of lead, and smelted them with a large excess of charcoal in the small furnaces shown in Fig. 4. The furnace was filled with the mixture of ore and charcoal, and then covered over with a heap of earth and turf. It was then lighted from below, and the metal, percolating through the mass, collected in a hollow beneath the furnace, and was ladled out into molds.

Within the last few years interest in the mines has been revived by the discovery that the Chinese worked them principally for the sake of the silver contained in the ore, and threw away the bulk of the lead in the form of slag, huge heaps of which now mark the sites of their smelting furnaces. A company has been formed with the object of collecting and smelting this slag, and has been engaged in constructing a tramway from Manhpwi, the nearest station on the Northern Shan States railway, to the site, in order to bring away the material and smelt it at some more convenient spot.

Up to the present time the company has confined its attention to the slags lying on the surface, but it should not be forgotten that, below the water level, there may still remain bodies of ore untouched by the Chinese miners, and it is to be hoped that as soon as the present scheme is in working order the ground

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Note—Abstract of paper published in "Records of the Geological Survey of India," Vol. XXXVII, Part 3, 1909.

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†Assistant superintendent, Geological Survey of India, Calcutta.

[1]London *Mining Journal*, Vol. LXXIV, p. 52.

[2]J. Malcolm Maclaren, *M.S. Report*, 1906.

[3]Symes, *Embassy to Ava*, p. 324.

[4]Crawford, *Journal of an Embassy to the Court of Ava*, pp. 427, 444.

[5]I am indebted for much of the information regarding the history of the mines to Dr. J. M. Maclaren, who was the first geologist to visit the mines, in 1905.

will be thoroughly prospected with modern appliances.

SITUATION AND PHYSICAL ASPECT

The mines of Bawdwin[6] are situated close to the northern border of the State of Tawng Peng, in approximate latitude 23 deg., 6 min., 45 sec., longitude 97 deg., 20 min., 30 sec., on the banks of a small stream called the Nam-pang-yun,[7] a tributary of the Nam Tu (Myitnge of the Burmese). For several miles round this spot the hills are almost entirely denuded of trees, but are thickly covered with grass.

The country for several miles to the south of the mines is quite uninhabited and covered with dense jungle, without paths, in consequence of which it was impossible to follow up the formations found to the south continuously into the Bawdwin area. Some doubt exists therefore, with regard to the exact position of some of the Bawdwin rocks.

Near the base the Silurian beds consist of coarse feldspathic grits, frequently pebbly, which are succeeded by finer sandstones as we recede from the old shore line, and finally by fine-grained sandy marls. They overlap the old Paleozoic or Ordovician beds, in such a manner that the latter are only visible at a distance from the shore line, where they happen to have been brought to the surface by subsequent earth movements. The Ordovician beds consist of shales, marls and limestones, usually rich in characteristic fossils, and known locally as the Naungkangyi beds. At the top of them, immediately beneath the Namhsim sandstones, is found a thin but persistent band of shales, the Panghsapyé graptolite band, containing graptolites of Llandovery types, resting upon a band of purple calcareous shales, which latter represent the purple Hwe Mawng beds of the ranges between the plateau and the Salween to the southeast of Lashio. The Namhsim sandstones are succeeded above by the limestone of the plateau, of Devonian or Carboniferous age, which does not extend to the west of the Nam Tu in the southern part of the area, but crosses it at the mouth of the Bawdwin river, or Nam-pang-yun.

The general sequence of rocks to the southward is the following: At a variable distance of two to five or six miles to the west of the Nam Tu, which in this part of its course runs almost due north and south through a deep gorge, is found an ancient land surface, composed of slates, quartzites and grits of pre-Ordovician age, along the eastern border of which rocks of Ordovician, Silurian and Devonian age were deposited in succession. These rocks have been traced northward from the neighborhood of Hsipaw, forming a broad belt along the valley of the Nam Tu. Along the outer or western edge of this belt Silurian grits and sandstones (Namhsim beds) are found resting directly upon the upturned edges of the rocks forming the old land surface, with a very irregular boundary, deeply eroded by the tributaries of the Nam Tu.

STRUCTURAL FEATURES

The chief structural feature in this belt of rocks is a great overthrust, which has been traced almost continuously from south to north from Panghsapyé to Bawdwin, a distance of about 30 miles, running parallel to the Nam Tu for the greater part of its course. Along this overthrust the Naungkangyi beds have been pushed up westward over the Namhsim sandstones, so that a broad belt of the former intervenes between two areas occupied by the sandstones, the latter to the east being found in their normal position under the Plateau limestone, and forming a precipitous scarp along the left bank of the river, with the graptolite and purple bands at its base; while to the west the sandstones dip beneath the Naungkangyi beds along the plane of the fault (see upper section, fig. 2).

The sandstones are found extending four or five miles along the gorge of the Nam-pang-yun below Bawdwin, with a regular easterly dip, until they disappear beneath the Naungkangyi shales. The overthrust passes through the feldspathic grits at Bawdwin, and there is no doubt that the mineralization of the rocks of that area is due to the intense crushing and dislocation of the rocks caused by it. In addition to the grits there are found in the immediate vicinty of Bawdwin patches of quartzitic sandstones and shales, with which is asociated, some miles to the west of the mines, a band of coarse conglomerate. It is extremely difficult to make out the relations of these beds with the grits and rhyolites, but the probability is that they are outlying patches of the Namhsim sandstone series, folded or faulted down among the older rocks.

A minor line of disturbance of the same nature as the principal overthrust appears to branch off from the latter at Bawdwin and, taking a more southerly course, passes close to Manglang, to the

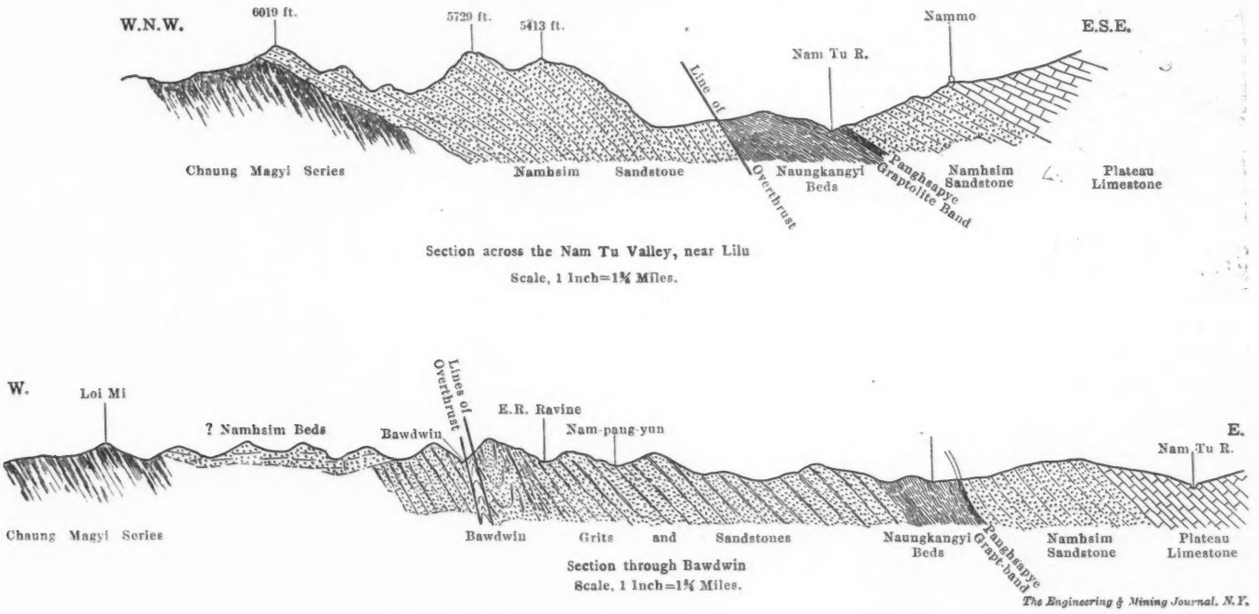


FIG. 2. SECTIONS THROUGH NAM TU VALLEY AND BAWDWIN

[6]Burmese: Silver mines. These mines are also known as Bawdwin-gyi, the great silver mine.

[7]Shan: The Stream of the peacock camp. Probably in allusion to the brilliant blue and green films of copper ores spread over the rocks at several places in the gorge.

south of which it seems to die out. The most intense amount of dislocation and crushing has therefore taken place at Bawdwin, where these two lines unite. Over a broad zone parallel with the plane of overthrust, through which the Nam-pang-yun has excavated a deep narrow gorge, the crushing has been of the most intense description, and the shear planes and fissures thus produced have afforded an easy passage for the mineralizing agencies from below (see lower section, fig. 2).

Ore Occurrence

The ore occurs in the form of nodular masses of finely crystalline galena, associated also with zinc blende, in which specks of copper pyrites are disseminated, and as granules impregnating the feldspathic grits, in which, as J. Coggin Brown observes, it appears to have replaced the feldspar. No ore was found in any of the adits left by the Chinese miners, who appear to have worked it out entirely so far as they could reach it, but the nodular masses were found in a section exposed by a slip, or perhaps an old quarry, at the upper end of the Bawdwin gorge (point B on map). Here they are imbedded in the grit, apparently coinciding with the bedding planes, but the country rock is in so rotten a state that it is difficult to make out the original bedding. The largest mass found here actually *in situ* measured about 2½ by 1 ft. Along the zone in which the nodules occur the grits are also strongly impregnated with galena. They are also traversed by thin films of copper ore, azurite and malachite, deposited along the joint planes.

The rotten state of the surrounding rock appears to be due to the formation of soluble sulphates and carbonates. There are no regular veins containing layers of the various minerals arranged in a definite order, and several of the minerals usually associated with galena, such as fluorspar and calcite, are absent. Strings and nests of white quartz are frequently to be found in the disturbed zone, but appear to have had no close connection with the development of the ore. Beds of massive barytes are also of common occurrence, but they were not found in direct association with the galena. In one spot (C on map) the barytes occurs in considerable quantity, in fragments up to a foot in diameter, scattered over the surface of a knoll over an area of 200 or 300 sq. yd., and evidently derived from the outcrop of a large mass. A number of other minerals of secondary origin are found in association with the ores.

The Mines

Most of the old Chinese adits at Bawdwin are situated in a narrow gorge of the Nam-pang-yun, at a point where it runs from north to south parallel and close to the zone of dislocation of the strata. The sides of the gorge, especially the eastern, on which side the greatest amount of disturbance has taken place, afforded a ready means of getting at the orebodies by driving horizontal or slightly inclined adits, obviating to a great extent the necessity of getting rid by artificial means of water draining into the mines. Some of the excavations descend below the level of the stream, and are now filled with water, but it is probable that none of them extend to any great depth. Others were driven almost vertically upward either to afford ventilation or to follow up rich bodies of ore, and were ascended by steps cut in the rock. It is probable that one at least was driven right through the hill into a narrow ravine (E on map) to the

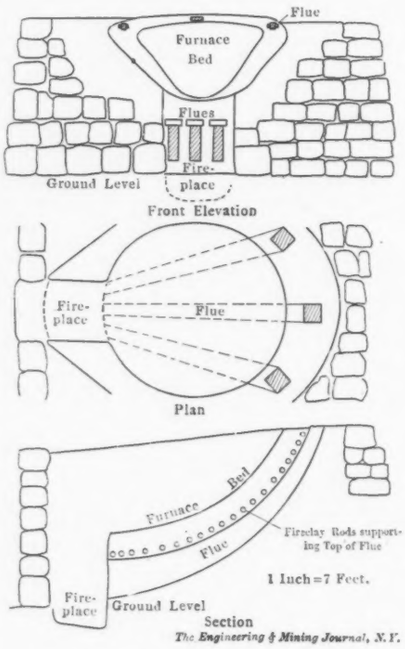


FIG. 3. LARGE SMELTING FURNACE

east (hereafter referred to as the Eastern ravine), where there are abundant traces of the ore having been washed from the angular talus with which the bed of the ravine is strewn. As there were no furnaces here, it is evident that the ore so collected was taken into the Bawdwin valley to be smelted. Little timbering seems to have been used. Indeed in most cases it was hardly necessary, because of the form given to the galleries, which are always arched at the top, and in bad ground of oval shape. They were so well designed that even now, after many years of neglect, many of them may be traversed in perfect safety. There was surprisingly little water to be found in them at the time of our visit, but no doubt the influx would be greater during the rainy season. The galleries vary in hight from about 3 to 5 or even 6 ft., and are usually well proportioned. At times they expand into irregular cavities, evidently places where large bodies of ore had been met with. This again indicates that the ore did not occur in regular lodes, but in masses or bodies of irregular shape and size.

There appears to have been no definite system of levels and headings, and in some cases one gallery has broken through, seemingly accidentally, into another; but on the whole one is favorably impressed by the excellence of the methods employed. Some of the ore seems also to have been extracted from open quarries, some of which are of large dimensions.

The mines extend along the course of the stream for a distance of about 3 miles to the point marked D on the map, above which the banks are too far from the zone of disturbance to admit of the ore being reached in this way.

Future Prospects

Since the area worked by the Chinese was limited to that which could be reached without much difficulty from the sides of the gorge of the Nam-pang-yun, and downward by the distance to which they could sink without being met with too great an influx of water to be dealt with in the absence of mechanical appliances, it is worth considering whether there is not still a large amount of ore left, which could be extracted profitably with modern mining equipment. I see no reason to suppose that such is not the case, and that if the ore is found on assay to be sufficiently rich in silver and lead, a profitable mining industry should not be established again at Bawdin. There is no reason to suppose that the overthrust, which has permitted the rocks to be impregnated with minerals, does not extend much further to the north, or that the rocks affected by it have not been mineralized in that direction. On the contrary, I am informed that the Chinese worked another locality to the north of Bawdwin, and that the traces of their activity are of the same description as at that place. In any case I think that the country should be adequately prospected, but in order that this may be done an accurate map is absolutely necessary.

In order to reach the ground left unworked by the Chinese at Bawdwin, shafts would have to be sunk, either in the Bawdwin ravine or in the Eastern ravine, or in both, and levels driven from them into the zone of disturbance. Shafts sunk in the Eastern ravine would have this advantage, that as the overthrust plane is inclined in this direction, there would be a less distance of dead ground between the shafts and the ore-bearing zone to be passed through. The water discharge on this side also would probably be less, though I do not think that it would be great in any case.

CHINESE METHODS OF TREATING THE ORE

Sufficient remains are left of the old furnaces and other appliances of the Chinese to enable us to form a fairly correct idea of their methods of treating the ores and extracting the silver. The ore after being washed and dressed as described below, was smelted in the large furnaces shown in fig. 3. These were placed in convenient positions on the hillsides at some distance above the bed of the stream, so as to allow plenty of room below them for dumping the slag. The furnace is of simple construction, consisting of a concave fire-clay bed or hearth of circular or oblong shape, sloping from back to front, where it is narrowed, imbedded in a mass of clay concrete built up inside a wall of stone or large bricks. The hearth was heated from beneath by three flues, the roof of which was supported by rods of fireclay, radiating from the back of the fire hole. The ore was mixed with charcoal, of which a large quantity is still left in the slag. As the reduction proceeded the lead ran down to the front of the hearth, and, percolating through the mass of fuel and ore filling the front of the furnace, collected in a hollow beneath the flues.

The smaller furnaces (Fig. 4) were, it appears from what I have been told by Mr. Freymuth, built by Kachins after the departure of the Chinese, in order to smelt the lead remaining in the slag. The design was apparently copied from the original Chinese furnaces, but they are built on a much smaller scale. The method employed in smelting has been described.

The lead was cupelled in beehive-shaped furnaces (Fig. 5), several of which are left in a very good state of preservation. These round furnaces appear to have been used for a preliminary extraction of the silver, the final purification being effected in the square furnace shown also in Fig. 5.

The Chinese do not appear to have made any use of the copper contained in the ore, and it is in such small quantity that it probably would not repay the expense and labor of smelting it in any case. They, however, extracted and smelted a small amount of copper ore near the village of Loi Mi, about 3 miles west of Bawdwin, where several heaps of copper slag are still to be seen. The excavations here are small in extent and were evidently made for prospecting purposes only. Similar heaps of copper slag and small excavations are to be seen near the head of the Nam-pang-yun, west of the Bawdwin mines.

THE ORE DEPOSITS AND SLAGS

By J. COGGIN BROWN

Mr. LaTouche has already given an account of the geology of the district around the Bawdwin mines. He has also dealt with the history of the Chinese occupation there, and has described in detail the methods then used in winning and smelting the ores. I accompanied Mr. LaTouche to Bawdwin in February, 1907, and had then an opportunity for examining the ore deposits and for collecting minerals, as far as circumstances would permit. These notes are based on observations then made and on the results of the examination of the specimens collected.

LIMITS OF INVESTIGATION

At the present time it is not possible to make a thorough study of the ore deposits. The whole area has certainly been well opened up by the extensive mining operations conducted there in the past, yet owing to the collapse of the old workings but little can be learned from them now. Some of the adit levels have been reopened by the Great Eastern Mining Company, and found to be constructed with no small degree of engineering skill, and to extend sometimes for considerable distances. I have examined most of these and have come to the conclusion, both from their large size and also from the absence of ore in them, that they represent the travellingways or haulage roads of the mines rather than the actual workings in the ore-bearing strata.

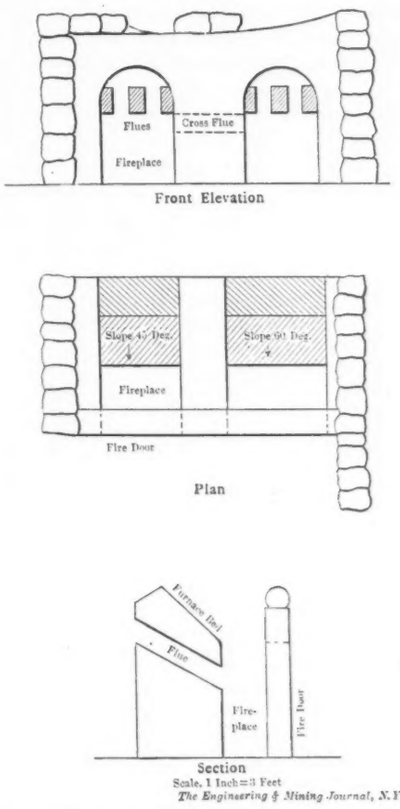


FIG. 4. SMALL SMELTING FURNACE

Attempts were made to enter the smaller workings in the hope that ore might be discovered *in situ* there, but owing to the decomposed condition of the rock, and the consequent danger of being crushed by falls, these had to be abandoned. There are, however, various orebodies which have not been worked to any extent by the Chinese and which crop out on the sides of the gorge. In such positions the ores have become generally oxidized, both from exposure to the air and from secondary alteration by surface waters, and consequently the true interpretation of their original condition is somewhat interfered with. Any conclusions which may be arrived at in these notes are therefore not to be regarded as final, for the many problems which present themselves in questions of this kind can only be definitely solved after a detailed examination and careful study of the whole of the underground structure of the area has been made.

As defined by the limits of the ancient Chinese workings, the metalliferous area at Bawdwin is a well marked one. Practically the whole of their mines are confined to the north of the main stream, which is known to the Shans as the Nam-pang-yun and has been renamed the Sterne river by one of the European companies holding the mining rights for the district.

EXTENT OF ORE-BEARING GROUND

As defined by the extent of the ancient workings, the ore-bearing ground is comprised in an area about 1½ miles long and between ¼ to ½ mile broad at its wider parts. This area comes entirely within the Bawdwin grit and rhyolite group of Mr. LaTouche.

The immense amount of material which has been taken from this ground in bygone days is only realized after seeing the number of adits which have been constructed (about 300 old openings—tunnels, shafts and open workings—are said to have been counted by the engineers of the present company), the remains of furnaces scattered over different parts of the valley, and the great heaps of slag which bear eloquent testimony to the quantity of ore smelted. While at the mines I was unaware of the fact that names had been applied to these different localities, but from the map which accompanies a manuscript report by Mr. Maclaren I have been able to make them out as the Jail, Maitland, Doormouse and Amphitheatre workings.

The ores which can be seen in these consist chiefly of galena and zinc blende, associated sometimes with small amounts of iron pyrites and chalcopyrite. Other minerals, as anglesite, cerussite, malachite and azurite, derived in all probability from the sulphide ores, are fairly common in some of these open workings. The ores do not occur in veins or lodes, but as impregnations in bands of the country rock, which usually consists of a coarse

rhyolitic tuff containing small rock fragments and a good deal of quartz. Occasionally only a small amount of the sulphides is seen distributed in an irregular manner through the rock. At other places, as in the Upper Maitland area, the ore-bearing band varies from 1 to 2 ft. in thickness and consists largely of galena and zinc blende; the country rock being sometimes entirely impregnated with these minerals.

The largest open workings are those of the Amphitheatre, but this great excavation, which forms a feature of the landscape for miles around, has doubtless been partially formed by landslips.

Metamorphism of the Country Rock

It is very difficult to say what the petrological characters of the unaltered country rock were, owing to the intense dynamic metamorphism which has taken place in the vicinity of the orebodies, and which has led not only to a mechanical effect in smashing up the rock and so rendering it permeable to mineralizing solutions, but has also been the cause of important mineralogical changes. I am, however, inclined to believe that the rock originally was a coarse rhyolitic tuff containing a large percentage of rock fragments. Feldspathic grits, quartzites and thin bands of true rhyolites are all found in more or less direct association with the tuff beds themselves. The grits especially have been affected by the general mineralization which has taken place.

Very often the entire rock has been so altered that it now consists largely of quartz grains set in a mosaic of quartz and feldspar, giving it in hand specimens the appearance of a fine-grained grit. Under the microscope, the mosaic is often almost cryptocrystalline, but sometimes it is developed on a larger scale, and each unit is seen to be quite homogeneous and fitting into the inequalities of its neighbors.

As far as the open workings of the Upper Maitland district are concerned (from which all the specimens here referred to came), the manner of formation of the ores was essentially a process of metasomatic replacement of the minerals of the country rock by metallic minerals probably carried in solution. The galena and other sulphide ores, zinc blende, pyrites and chalcopyrite, attacked first of all the feldspar in the rock. As the replacement went on the mosaic-like groundmass gave way to the sulphides, and finally the quartz grains themselves were partially or entirely replaced.

Order of Deposition

The ores found in the open deposits consist as a rule of galena and zinc blende associated with small quantities of iron and copper pyrites. As a rule, if copper pyrites is present with the galena, the amount of zinc blende is much less. All the sulphides except zinc blende have been found occurring alone in small amounts.

As regards the order of deposition of the sulphides, the microscopic examination of various specimens shows that iron and copper sulphides when present with the others were the first to be deposited. In the case of the lead and zinc sulphides, the relationships are somewhat ambiguous. Galena has been found surrounded by and also surrounding zinc blende. The latter is by far the commoner case, and it may be assumed that as a general rule the zinc blende was deposited prior to the lead sulphide. In all probability the deposition of all the minerals was proceeding in different places at the same time, and the order copper and iron pyrites, zinc blende and galena represents broadly the general rule for deposition only with respect to the area from which the specimens examined came.

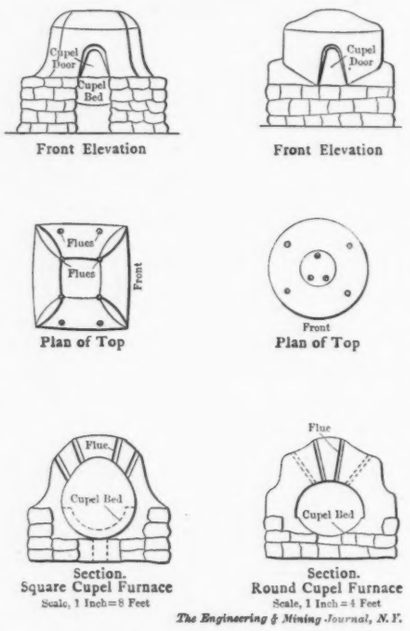


FIG. 5. CUPEL FURNACES

Most Important Minerals

Galena is usually found in irregular crystals, picked specimens showing from 63 to 104 oz. lead per ton. Anglesite is common, but more abundant at the Upper Maitland workings. Cerussite is found in association with anglesite and galena. Barytes is fairly common, but has not been noted in direct association with any of the sulphide ores. Zinc blende is common, especially at the Upper Maitland and Jail workings, where it occurs associated with galena, iron pyrites and chalcopyrite.

Chalcopyrite occurs sparingly in small grains disseminated in the country rock. Iron pyrites is not uncommon; it is widely distributed and often accompanied by chalcopyrite. Malachite and azurite are noted wherever copper ores occur. Smithsonite has been noted.

Notes on the Slags

The Chinese, from the commencement of their operations in the 14th century until the year 1868 when they finally abandoned the mines, apparently worked and smelted the ores chiefly for the silver which they contained, allowing the greater part of the lead compounds and probably the whole of the zinc to run into slags. Great heaps of these extend at intervals for over two miles along both banks of the Nam-pang-yun. The location of the smelting furnaces appears to have been dependent on sites suitable for fuel and for water for dressing the ores, rather than on close proximity to the levels themselves.

Granting that by the preliminary operations of washing and dressing the ores the Chinese were able to commence with a practically pure galena, and granting that the silver content of the Maitland ore be taken as a guide, then we may assume that they started with material carrying about 80 oz. of silver per ton, while they finished with a slag containing roughly 1 to 2 oz. per ton. Of course modern methods of silver extraction would do better than this, but taking all things into consideration the Chinese methods though crude were essentially successful.

The slag or lead matte itself usually consists of heavy, dark-colored, porous material sometimes of a vitreous aspect, but more often stony in appearance. It is largely intermixed with charcoal, doubtless the remains of the fuel by which the ores were reduced, and it is permeated by small shots or spherules of metallic lead.

Some of the more ancient heaps are now largely intermixed with débris and rubbish which has fallen from the hillsides, but it will not be a difficult matter to extract the valuable material. The slags contain from 47.8 to 49.3 per cent. lead, 16.7 to 18.20 zinc, 2.5 oz. silver and variable amounts of gold. Small amounts of copper, arsenic, iron, aluminum, manganese, calcium, silica and sulphur are also present, but not in quantities large enough to make them of industrial importance. The small amounts of sulphur are noteworthy as they probably indicate a preliminary roasting of the sulphide ores. It is, however, not uncommon to find small lumps of undecomposed galena in the slag. The heaps are quite accessible and the amount of slag recoverable has been variously estimated at from 110,000 to 125,000 tons. The slags should certainly prove a valuable source of lead if their treatment be approached in a scientific manner.

Some Economic Considerations

The Burma Mines Railway and Smelting Company, Ltd., which at present is the owner of the mining rights of the Bawdwin property, acquired from the Great Eastern Mining Company, Ltd., its partially constructed railway to the mines and is now engaged in carrying it forward.[8] On completion of the line, the company proposes to proceed with the smelting of the slags before undertaking the development of the mines.

In the event of the development of a mining industry at Bawdwin, the question of the supply of labor is one which will demand serious attention. To recruit coolies from the inhabitants of the country would certainly be the least expensive method of solving the problem, but it is to be feared that the Shans would prove practically useless for work of this kind. The question, therefore, resolves itself into the use of Chinese or Indian labor, or a combination of both, for it is doubtful if Burmese labor would be satisfactory. It will be best to employ Yunnanese as much as possible.

Transportation

By existing paths the mines are inaccessible, and to get to them tedious journeys over mule-tracks of the usual kind found in mountainous frontier districts have to be made. A light railway, however, is now under construction, and when completed will connect the mines with the station of Manhpwi, which is a few miles above Hsipaw on the Shan State branch of the Burma Railways. This light railway will be about 40 miles long, and will place the mines in direct communication with the port of Rangoon at a distance of about 590 miles. Transportation by water along the Nam-Tu river from Hsipaw has been proposed, but there are difficulties in connection with this method which I believe are unsurmountable. The Nam-Tu river, like most of the streams of the Shan States, is frequently crossed by tufa bars and dams, which besides making navigation excessively dangerous, if not impossible, create rapids which no boat can cross. For these reasons I consider that transportation of the ores or finished material by water is out of the question, although it would have been by far the cheapest method.

General Conclusions

(1) The Bawdwin ores, as far as can be gathered from material left by the ancient Chinese, consist of argentiferous galena with smaller quantities of zinc blende, iron pyrites, chalcopyrite, and various other minerals derived from these.

(2) The ore deposits at present visible do not occur in veins or lodes, but in bands of rock impregnated with minerals.

(3) While the greater part of the area above water level has been exploited in the past by the Chinese, there is a good chance of meeting with payable ores at greater depths. Exploration for this purpose by means of borings is strongly advocated, together with the careful and systematic prospecting of the surrounding district.

(4) The slags left by the Chinese workers are rich in lead and also contain a good deal of zinc. There appears to be no reason why they should not constitute a valuable source of these metals, if their treatment be approached in a scientific way.

(5) In case of mining developments at Bawdwin, the question of a labor supply will have to be faced. Considering the natural aptitude for mining which the Yunnanese display, combined with their industry and endurance, it is concluded that it will be best to employ them in preference to Indians, Burmese or Shans.

[8]Since the above notes were written, this line has been completed and smelters have been erected on Mandalay shore.

State Mineral Lands in the Transvaal

Special Correspondence

The Transvaal government is calling for offers for another state mineral area on the Witwatersrand. This consists of several groups of claims, totalling 144, partially underlying the townships of Boksburg and Vogelfontein. This call for tenders, however, is under section 52 of the gold law, whereas the two Modderfontein areas fall under section 46.

The lease is similar in conditions to those of the Modderfontein areas described in the Journal of Aug. 7, 1909, and will run for a period terminating with the exhaustion of the payable precious metal. These areas are bounded on the north and southeast by the East Rand Proprietary Mines and on the southwest by the Cinderella Deep.

It is calculated that, provided no unforseen difficulties arise, £180,000 will be required for shaft sinking and preliminary development, and a further sum of £140,000 to bring the property to the full producing stage. It will be recalled that in the case of each of the Modderfontein areas, the sum of £350,000 was allotted for shaft sinking and preliminary development and an equal amount of equipment.

It is stipulated that 25 per cent. of the preliminary capital required must be offered for subscribtion to persons resident in the Transvaal, subject to a minimum personal subscription of 10 and a maximum of 200 shares. This provision for public participation has been inserted as a kind of compensation for the abolition of the right of pegging which was allowed under the earlier gold laws. It is stipulated that no venders', promoters' nor founders' shares shall be created and no commission or underwriting will be allowed. No shares may be issued at less than par, and all capital for preliminary work must be issued at the same price.

The grade of the East Rand Proprietary Mines is about 30s. ($7.30) per ton; while with the equipment that would be applied to this area, if worked separately, the cost would be about 20s. ($4.85). The Cinderella Deep, on its present restricted output of 13,000 tons per month, works at 21s. 4d. ($5.19). But it is improbable that the areas will be worked independently. They could be easiest opened from either the Cason shaft of the East Rand Proprietary Mines or from the Cinderella Deep. Upon exhaustion of the mineral, the government becomes entitled to 10 per cent. of the proceeds from the disposal of residual plant, buildings, etc. of the leasing company.

Tungsten Ores in Canada

A report on the tungsten ores of Canada, by Prof. T. L. Walker, of Toronto University, has just been issued by the mines branch of the Department of Mines of Canada, at Ottawa. The report covers 56 pages, and includes 15 illustrations. The several occurrences of tungsten ore in Canada are described in detail, while a general statement is given on the geological occurrence of the ores, chemical tests, concentration, the uses of the metal, producing mines in other countries, statistics of the world's production, etc., together with a useful bibliography of the literature on Canadian and United States occurrences.

Correction

In the article on "The Los Angeles Oil Industry," by Percy E. Barbour in the Journal of Aug. 21, 1909, on page 366, one line was omitted from the description of the standard California rig, which should have read as follows: "This rig is the standard ordinary rig with the addition of a secondary reel known as a 'calf wheel', which is necessary to handle the casing required by the formations of this district and of California oilfields in general," etc.

A notable reduction of working costs has just been achieved at the Van Ryn, which is situated on the northern outcrop of the eastern extension of the Rand. The total costs for June were $3.13 per ton. Deducting development costs the net working cost is a trifle over $2.68 per ton, the net working cost at the Simmer & Jack, but the Van Ryn crushed only 33,600 tons as against 67,500 handled by the Simmer & Jack.

Dressing Plates as Affecting Amalgamation *

Following the successful installation of tube mills in reduction works practice on the Rand and the consequent coarse crushing of ore by the stamps, it appeared to me that longer intervals of time between the dressings of battery plates would not materially affect the percentage of gold recovered by amalgamation, as owing to the coarse sand and increased tonnage passing over the plates, the surface remains bright, and a comparatively small amount of black sand is caught thereon. Even should the extraction be slightly less, it might still be advantageous to dress plates at longer intervals, seeing that there is a secondary amalgamation to follow on the tube mill plates.

Under the New Gold Law Regulations, covers with double locks have to be used on all mill plates. This necessitates the presence of two white men each time these covers are removed, and as every dressing entails extra labor and the withdrawal of shiftsmen's attention from the efficient running of the mill, it is clearly evident that any reduction in the number of plate dressings required would be beneficial to general mill practice, provided the total extraction be not detrimentally affected.

Trials were accordingly undertaken to prove the truth of this contention, or otherwise, with the following results:

During November, December, 1908, and January, 1909, all plates in the mill were dressed at eight-hour intervals, and in February, March and April, 1909, at twelve-hour intervals.

Table I gives a comparison of the results obtained for the two periods involved. It will be noticed that the extraction is higher for the period of 12-hour dressings, but on the other hand, and in part explanation of this, the gradings show a finer product passing over the plates during that trial.

A further experiment, covering a period from Feb. 11 to Apr. 19, 1909, was undertaken to determine the extraction at different intervals of time between the dressings of the plates, and the results are as embodied in Table II. From this table it will be seen that the extraction progressively improves up to six hours from the time of dressing plates, and then falls off again, until at the end of twelve hours it has dropped to 49.10 per cent., or 0.09 per cent. lower than that obtained three hours after dressing. The hightest extraction of 53.57 per cent., obtained 6 hours after dressing, has an original value of 8.38 dwt., while for the lowest extraction, viz., 49.10 per cent., obtained 12 hours after dressing, it is only 7.79 dwt., this being the lowest original value in the tables. In addition, it is to be noted that the percentage of +0.01 grade is lowest for the highest extraction.

As a result of these tests, I have adopted 12-hour intervals between the dressings of mill plates, which appears to be sufficient under the conditions obtaining at the Simmer and Jack, but I would not advocate others doing the same without making preliminary tests, as the same results may not be obtained in every case.

In conclusion, I may say that the plates must be in good order, and a sufficient setting of amalgam must be left after clean-up. If plates are scraped down to bare copper, a practice only too common in some mills of the Rand, good amalgamation will not be obtained even with dressings every four hours.

I am making similar tests on the tube-mill plates, where there is considerably more black sand. Probably these plates will not run as long as the mill plates without dressing, but from the figures already obtained, it would appear that they do not require dressing every four hours.

*Abstract of an article by G. O. Smart in *Journ., Chem., Met. and Min. Soc., of South Africa*, June, 1909.

TABLE I. EXTRACTION ON MILL PLATES.

	Heads, Dwt.	Tails, Dwt.	Extraction, Dwt.	Extraction, Per Cent.	Grading. +0.01	Grading. —0.01 +0.006	Grading. —0.006
Three months' run, 8 hours between dressings	7.584	3.952	3.632	47.890	40.90	13.03	46.07
Three months' run, 12 hours between dressings	7.359	3.818	3.541	48.118	38.27	12.97	48.77

TABLE II. PLATES DRESSED EACH DAY AT 6 A.M., AND NOT DRESSED AGAIN DURING THE TIME OF TAKING SAMPLES.

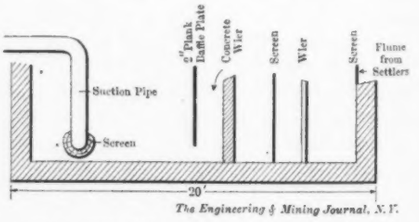
Date.	9 a.m. (3 hrs. after dressing). Heads, Dwt.	Tails, Dwt.	Extraction, Dwt.	Extraction, %	12 noon (6 hrs. after dressing). Heads, Dwt.	Tails, Dwt.	Extraction, Dwt.	Extraction, %	3 p.m. (9 hrs. after dressing). Heads, Dwt.	Tails, Dwt.	Extraction, Dwt.	Extraction, %	6 p.m. (12 hrs. after dressing). Heads, Dwt.	Tails, Dwt.	Extraction, Dwt.	Extraction, %
February 11	7.45	4.55	2.90	38.93	6.30	3.80	2.50	39.68	5.25	3.05	2.20	41.90	6.80	3.90	2.90	42.65
12	8.05	3.80	4.25	52.80	14.82	6.75	8.07	54.45	14.00	5.75	8.25	58.93	10.70	4.50	6.20	57.94
14	9.53	4.60	4.93	51.73	9.70	5.43	4.27	44.02	7.65	4.95	2.70	35.29	10.10	4.35	5.75	56.93
March 18	10.57	4.63	5.94	56.20	10.45	5.15	5.30	50.72	8.65	4.57	4.08	47.17	10.50	5.44	5.06	48.19
21	10.03	5.35	4.68	46.66	6.25	2.80	3.45	55.20	8.15	3.00	5.15	63.19	6.20	3.37	2.83	45.65
31	7.15	3.30	3.85	53.85	5.67	2.32	3.35	59.08	5.10	3.15	1.95	38.24	8.20	4.77	3.43	41.83
April 6	4.60	2.38	2.22	48.26	6.20	2.60	3.60	58.06	8.56	3.24	5.32	62.15	5.28	2.28	3.00	56.82
9	8.09	3.72	4.37	54.02	7.84	2.92	4.92	62.76	8.28	3.22	5.06	61.11	7.40	3.60	3.80	51.35
16	6.68	3.00	3.68	55.09	6.70	2.72	3.98	59.40	6.20	4.80	1.40	22.58	5.84	4.08	1.76	30.14
19	7.76	3.84	3.92	50.52	9.92	4.44	5.48	55.24	8.24	4.00	4.24	51.46	6.88	3.36	3.52	51.16
Averages	7.99	3.92	4.07 Average.	50.48	8.38	3.89	4.49 Average.	53.57	8.01	3.97	4.04 Average.	50.39	7.79	3.97	3.82 Average.	49.10
Grading																
+.01	38.57	36.47	37.52		37.93	36.27	37.10		37.90	36.80	37.35		38.00	36.71	37.36	
—.01 + .006	17.26	17.61	17.44		17.46	17.10	17.28		17.29	16.96	17.13		17.53	17.27	17.40	
—.006	44.17	45.92	45.04		44.61	46.63	25.62		44.81	46.24	45.52		44.47	46.02	45.24	

Disposal of Slimes and Tailings at Stella Mine, N. Y.

On account of the litigation that is likely to ensue, the disposal of the slimes and tailings from milling operations is often the most serious problem that the mine manager has to overcome. A brief description is given of the method used by the St. Lawrence Pyrites Company at its Stella mine.

Slimes

Just below the mill are two settling reservoirs, which are used alternately. The slimes are run direct from the mill



APPARATUS FOR RECOVERING WATER FROM SLIMES

to one of these slime ponds where the fine material is allowed to settle. The water is pumped back and used over at the mill. When the reservoir is full, the second settling basin is then used. A sluice gate is opened and about one-half of the slimes in the first pit are sluiced out by means of a fire hose and nozzle to another pit where

a retaining dam has been built. The remainder is then shoveled into ore cars and wheeled out to the waste dump. The overflow water from the settling reservoirs that is not used for the mill is allowed to settle in a third reservoir where the last fines are taken out. Each of the upper settling ponds is cleaned out two or three times per year.

In order to prevent freshets from taking out the slimes that accumulate in the settling basins a diversion ditch was constructed above the mill which turns the channel of the small water course in which the mill is situated. Since all of the water that is used in the mill is pumped from a small creek and elevated more than 100 ft., the recovery of water from the slime pits is a great saving.

An accompanying drawing shows the sump from which the water is pumped back to the mill. The water is not filtered, but it returns sufficiently clear to be used again in the milling of ore. The mill at present is treating 300 to 350 tons of ore per day.

MILL OF THE ST. LAWRENCE PYRITES COMPANY

SLIME PITS OF THE ST. LAWRENCE PYRITES COMPANY

Tailings

The tailings from the Hancock jigs are removed by a bucket elevator to a large storage bin outside of the mill building. These bins are constructed directly over the railroad tracks. The surplus water which is carried to the bins passes off at the top through a trough to the slime pond The railroad cars are run under the bin and valves are opened to allow the tailings to discharge into the car. The car used for this purpose is an ordinary side-dump 50-ton car. However, for this particular use the swinging door on one side was closed permanently and a false bottom built in this side of the car. This of course reduces the capacity, but allows the material to be discharged all on one side. A 2-ft. lip extends from the side of the car so as to carry the material off the track and nearer the edge of the waste pile. These cars are handled by a standard-gage locomotive in trains of 2 cars.

The production of tin in Singkep, in the fiscal year ending July 31, 1909, was 7000 straits pikuls.

Most Profitable Grade of Ore

Special Correspondence

The report of the Robinson Deep Gold Mining Company, one of the most important mines of the central section of the Transvaal, has recently been issued. During the last financial year, the mine has made a record profit, but the prospects for the future are not altogether satisfactory. During the last three years, the ore reserves have shown a considerable decline, in spite of the fact that the grade has been reduced which, according to the experience of other mines, should have resulted in a large increase in tonnage. The falling off in development is attributed to a want of shaft capacity, the requirements of the mill leaving no time for sinking at the rate desired. One of the shafts is to be widened from a three-compartment to a five-compartment shaft.

A few years ago this mine used to give a yield of over 40 shillings per ton. During this last year the yield has dropped to 33s. 7d. and during the last quarter to under 30 shillings per ton. The increase of the mill from 200 to 300 stamps no doubt partly accounts for this drop, for with the increased output costs have been reduced, allowing lower-grade ore to be profitably extracted. The change of policy in mining lower-grade ore than formerly is not, however, the sole reason for the drop in grade, there being also a general decline in the value of the reef developed.

The question of what is the most profitable grade to mine is a controverted subject. Naturally the higher the grade is kept the higher will be the working expenses, the greater the profit per ton and the shorter the life of the mine. The general policy of the Rand of late has been to mine ore which approaches the pay limit with the result of exceptionally low costs, owing to the greater width of the stopes and the less cost of development.

Some mines, however, like the New Heriot, aim for a high yield, placing little weight on high costs as compared with their neighbors. Which of the two policies is right depends on whether the high profit over a short period is, when calculated in terms of present worth, more or less than the smaller profit spread over a longer period. A suggestive paper on this subject by the manager of the City and Surburban mine, H. Musson Thomas, published in the *South African Min. Journ.* of July 17, 1909, puts forward the view that mining should be carried on more closely than it is at present. There is, according to him, too much waste mined and milled.

In a hypothetical case he calculates that on a mine equipped with 200 stamps the value of the property would be increased 20 per cent. by reducing the stopes from 60 to 36 in. The question of what is the most profitable grade is one that requires careful consideration by mine managers. Low costs do not by any means spell the maximum profit, and it is quite possible that the reduction in grade which so many of the mines have introduced is, from a financial point of view, a step in the wrong direction.

There are three difficulties (*West. Chem. and Met.*, July, 1909) in burning fuel by a straight down draft. (1) With coal it is very difficult, if not practically impossible, to consume all the carbon to produce gas; (2) the ash has to be allowed to accumulate in the machine until the resistance becomes so great as to prohibit the flow of gas, thus necessitating intermittent work and expensive labor in removing clinkers from the furnace; (3) this intermittent work results in a variable gas which tends to vitiate the regular operation of the engine.

The consumption of nitrate for the first seven months of 1909, as announced by the Nitrate Development Association of Iquique, Chile (*Min. Journ.* Aug. 21, 1909) was 2,500,000 quintals in excess of that for the corresponding period of 1908. The production, however, was 1,500,000 quintals less.

Notes on the Evaporated Salt Industry of Kansas

Over 2,500,000 Barrels Produced in 1907; Extent of Beds Unknown; Operations of the Joy-Morton and the Cary Companies Described

BY C. M. YOUNG*

The salt beds of Kansas are a part of the Permian strata. Apparently for a considerable time the water of a salt lake or arm of the sea was concentrated by evaporation, depositing during the process a layer of salt. Gypsum occurs below the salt in some places, and probably underlies the whole bed, as would be expected from the fact that calcium sulphate is much less soluble than sodium chloride.

That the deposition of salt continued during a long period of time is shown by the fact that the salt beds, consisting of salt interstratified with shale, reach a thickness in some places of 404 ft.; whether they are thicker than this at any point is not known, as the whole field has not been explored.

The area known to contain the salt beds is shown in the accompanying map reproduced from one made by the State Geological Survey. The fact that the beds grow thinner toward the east gives a good idea of their eastern extent. It is probable that they do not reach to the northern boundary of the State. The southern limits are not known, but they are found in Oklahoma. The westward extent is entirely an uncertain matter as no explorations have been made which indicated an approach to the limit of the beds. Thus the eastern and northern shores of the Permian lake or sea are roughly known, but its southern and western boundaries have not been determined.

Two Methods of Working the Beds

These salt beds were discovered in the search for oil and gas which accompanied the boom of 1887 and 1888. The finding of the salt was a disappointment in most cases, but later its value was recognized, and it has become a source of large revenue.

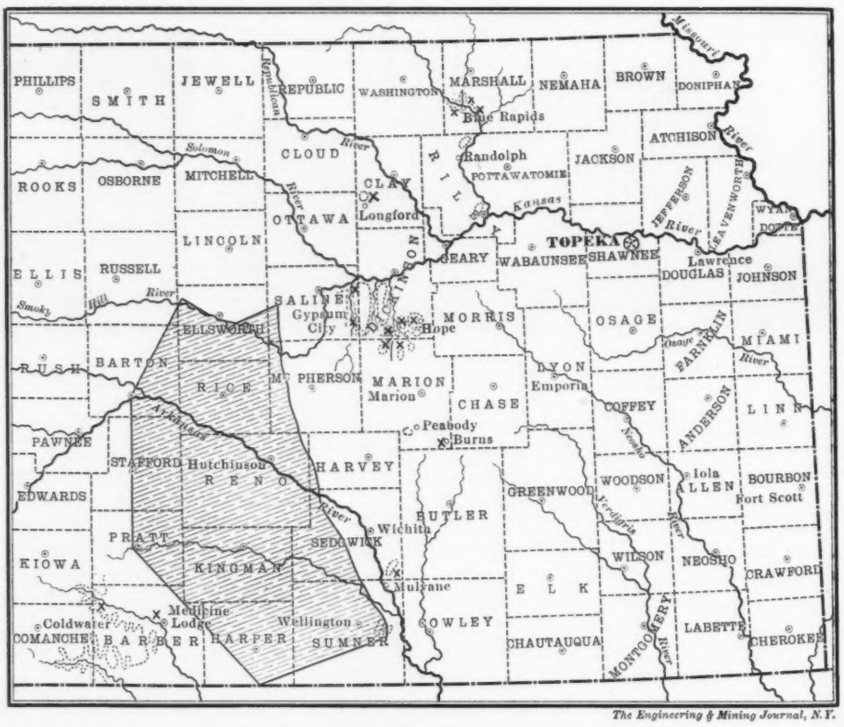
By far the larger part of the salt is extracted as brine, but some is mined as rock salt. These salt mines are very interesting and will be described in a later article. The salt is mined by the methods used for thick coal beds, and is ground and screened. The lump salt commands the highest price. It is used for salting cattle, lumps being left on the ground where the cattle can have access to them. The rock salt is slightly less pure than that obtained by evaporation, because most of the evaporating processes remove the calcium sulphate which is present in small proportion: It is, however, a nearly pure salt.

The evaporated-salt industry has its center at Hutchinson. There are, however, many plants in the surrounding territory. Some of these are evaporating plants only, while in others the evaporation of brine accompanies other enterprises, exhaust steam being the source of heat for the evaporation process. For example, the compressors of an ice plant or cold-storage plant are driven by steam and the exhaust used to evaporate brine.

Evaporation Processes

In all cases the brine is obtained from wells. A 5⅝-in. casing is driven for about 200 ft., being bedded in shale. A 2½-in. pipe extends from the top nearly to the bottom of the well. Water pumped down through the small pipe becomes saturated with salt and flows out of the casing. As more salt is dissolved the surface exposed to the water becomes larger and the capacity of the well increases. An old well will produce about 200 gal. of brine per minute, bearing 2.19 lb. of salt per gal. The solar process of evaporation without the use of artificial heat has been almost entirely abandoned.

Of the processes in which artificial heat is employed, the oldest and simplest is the direct-heat process. In this there is no use of steam, either live or exhaust, but the pans are heated by fires beneath them. The pans, made of sheet iron 3/16 in. thick, are 24 to 25 ft. wide and 85 to 115 ft. long. They are supported on brickwork and heated by direct firing below. As the water evaporates the salt crystallizes out and collects on the bottom. It is raked by hand labor onto the sloping drip board, a large hoe being used. As the temperature of the rooms is high and the air humid, the work of tending the pans is unpleasant, and, when the vapor condenses in the air, dangerous because a misstep might result in a fall into the boiling brine.



MAP SHOWING KNOWN KANSAS SALT BEDS

As the temperature of the pan bottom is quite high the formation of a scale of calcium sulphate gives a great deal of trouble. This scale has to be broken loose and removed by hand. The direct-heat process has been almost entirely superseded by the grainer and vacuum processes which are considerably more economical.

Grainer Process

This process was developed in Michigan. During the later days of the lumber industry of the lower peninsula it was found that the exhaust steam from the sawmills could be profitably used to evaporate the

*Hiram, Ohio.

brine which is found under a large portion of the region. Many "salt blocks," as the plants were called, were erected, and the decline of the great lumber industry was contemporaneous with the beginning of the salt industry of the State.

As the Michigan brine contains a considerable quantity of bromides which remain in the mother liquor from which the salt has been deposited, bromine stills were erected which produced liquid bromine, and the mother liquor formerly wasted became a source of revenue. It should be said, however, that the largest bromide plant in America, situated in Michigan, which produces more than half of the bromides originating in this country, has never produced salt, only the calcium and magnesium salts in the brine being decomposed while the sodium chloride is discarded. No bromine has been found in Kansas in the districts where salt is produced, but it is present in some parts of the State.

Operation of Grainer Process

The grainer process, as it was developed in Michigan and introduced into Kansas, is as follows: A pan of about the same form as used in the direct-heat process is employed. In this pan is placed a steam coil of 3-in. pipe suspended from timbers extending across the pan. Generally eight lengths of pipe are used. The low-pressure steam enters at the middle of the tail end, divides and passes through the coils on each side and is trapped out at the head end. As the process was first used the salt was raked out by hand upon dry boards, as in the direct-heat process.

At present this method of removing the salt has been abandoned and mechanical rakes are used. These consist of frames hung on wheels, which run along tracks on the sides of the pans. The frame over each pan carries at intervals of about 9½ ft. a swinging rake which runs below the pipes and when in its lowest position, not quite vertical, scrapes the bottom of the pan. The frame is given a reciprocating motion and, as the rakes move toward the head of the pan, the salt is carried in that direction. When the motion is reversed the rakes tip upward and ride over the salt. The rakes are driven by hydraulic plungers, by pitman and gear, or by rack and pinion. In this way the salt is carried up the drip board, and in some plants is pushed from the dry board upon a belt conveyer which carries it to the curing room. The travel of the rakes is such that there is a lap of about 1 ft. As hand labor is thus reduced to a minimum, the labor cost of the process is low.

The heat of the pipes causes the deposition of calcium sulphates, but as this is deposited on the pipes instead of on the pan bottom, its removal is probably less difficult.

Large Crystals Formed

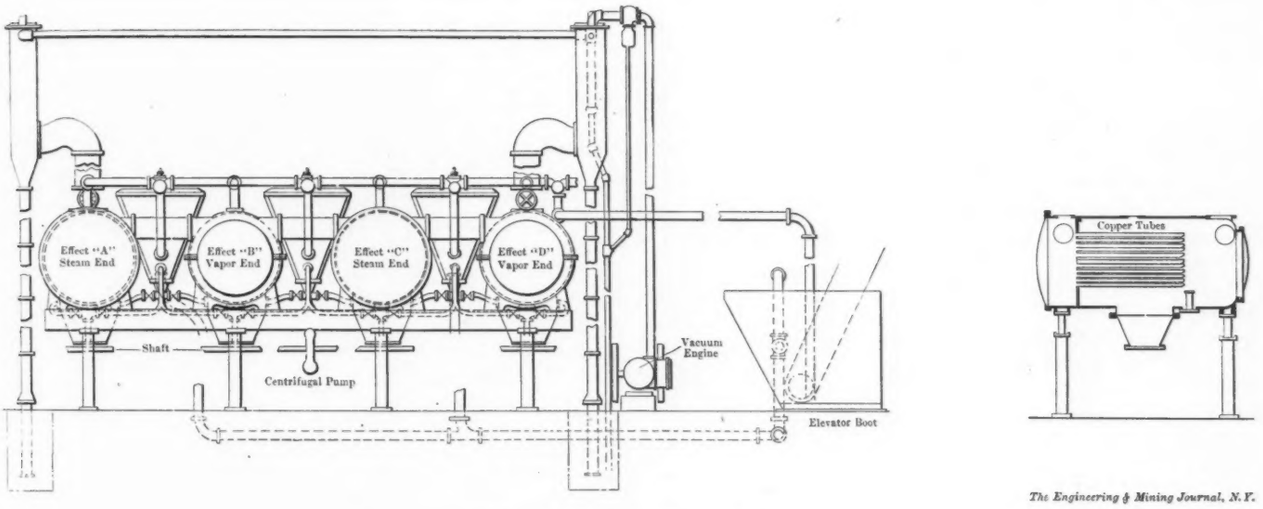
Naturally, the grainer process tends toward the formation of rather large crystals and crystal masses. This is especially true in the old hand-raking process in which the salt is lifted, or raked out, only six or seven times per day of 24 hours. The agitation caused by the mechanical rakes partly overcomes this difficulty. After the salt is removed from the grainers it is elevated to the second floor of the building, loaded into large carts and wheeled along runways from which it is dumped to the floor below. In the older processes in which the salt had a good opportunity to drain, it carried comparatively little water. In the modern plants the salt is carried by elevators to the runway floor. These elevators are in most cases of the link-belt type with wire-cloth buckets which allow the salt to drain.

The salt remains on the curing floor from 20 to 60 days to drain, and during this time the heaps settle several inches, the salt becoming so compact that it has to be mined with picks. Most of the salt is packed directly from the heap into barrels holding 280 lb., or into sacks holding 50 lb. A portion is loaded directly into box cars. It would be desirable to have a mechanical loader to do this work, but none has yet been designed.

A portion of the salt, intended for dairy and table use, is dried in revolving kilns, These are of wood, about 6x40 ft., slightly inclined and fed at the upper end by a mechanical elevator. Inside the wooden drum is a smaller steel drum heated by steam. Flights on the inside of the wooden drum elevate the salt which falls upon the hot steeel drum. The moisture is carried away by an air current which also removes a large part of the dust.

Apparatus for Vacuum Process Costly

In the modern plants, having the best equipment, the vacuum process is used. In this process the brine is heated in an airtight vessel and the steam condensed. The partial vacuum thus produced lowers the boiling point and permits a greater evaporation per pound of steam used than is possible with the grainer process. The vacuum process apparatus is costly, and is, therefore, used only by the large producers. The two types used will be described as they were observed in two of the principal plants at Hutchinson.



QUADRUPLE-EFFECT SALT EVAPORATOR

The Joy-Morton plant of the Hutchinson-Kansas Salt Company is situated on the south bank of the Arkansas river, opposite Hutchinson. This plant has 25 wells and probably produces more salt per year than any other in the world. Its capacity is 3000 bbl. per day. Some Michigan plants may have a greater daily capacity, but they are shut down at the close of navigation on the lakes. Including a few women in the table and dairy packing room, the employees number about 175. Most of the labor is of a skilled or semi-skilled class.

Vacuum Process at Joy-Morton Plant

The plant uses both the grainer and the vacuum processes. The vacuum-process plant consists of three large pans, technically called effects. The brine in each is independent of the others, and each has its own feed pipe and elevator. Steam is supplied by six 400-h.p. marine-type boilers. These are generally fired with natural gas from the southern Kansas field, but are supplied with oil burners for emergency use. Eight 150-h.p. horizontal tubular boilers supply the grainer pans.

Each vacuum effect consists of two funnel-shaped zones, one inverted above the other, separated by a cylindrical zone. They are about 60 ft. high by 20 ft. in diameter. This middle zone consists of an annular belt of vertical 2-in. copper tubes, 2750 in number, open at top and bottom, through which the brine circulates like water in a water-tube boiler. In the open center space is a 10-ft. propeller, hung on a vertical shaft, driven by gearing at the top of the effect. This propeller creates a downward current of brine in the middle of the effect and a return upward current through the copper flues. The salt crystals carried down by the central current are not raised, but descend to the elevator boot.

Brine is fed in at the side of the upper zone. Steam is led to a ring surrounding the top of the effect, then through pipes to the steam belt surrounding the center zone. The lower zone is nothing but a settling well for the salt which, falling to the elevator boot, is carried up to the draining bins, from which after the water has drained out it goes to two rotary dryers similar to those previously mentioned.

As the effect is under a partial vacuum the brine level in the elevator housing is lower than in the body of the effect. The whole effect, excepting the copper flues, is made of heavy iron castings. The steam belt of No. 1 effect is supplied with live steam at 2 lb. pressure. The water of condensation is trapped out from the steam belt of each effect. The body of No. 1 effect is connected with the No. 2 steam belt, and the body of No. 2 with No. 3 steam belt. Thus the water vapor from No. 1 furnishes the heat for No. 2, and the vapor from No. 2 heats No. 3. The body of No. 3 is connected to a walking beam vacuum pump having two air cylinders 44x48 in., running at 30 r.p.m. and having a capacity of 5050 cu.ft. of free air per minute. The vapor goes from the pump to a jet condenser.

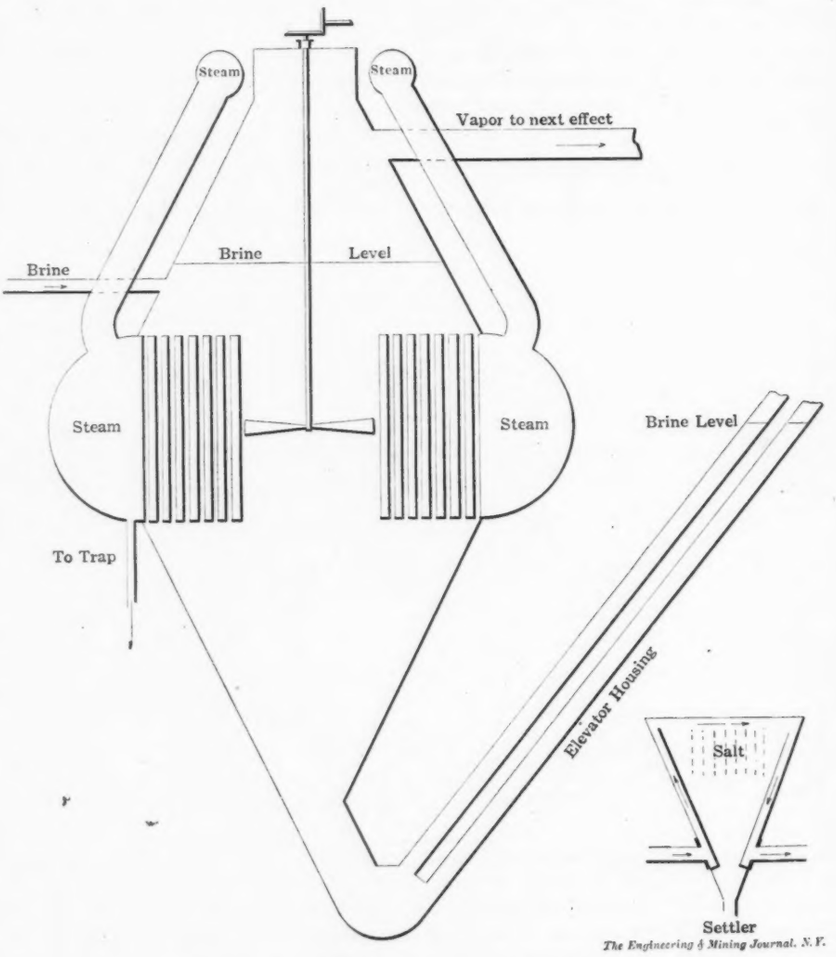
The vacuum measured in inches of mercury is, on the body of No. 1 and steam belt of No. 2, 12 in., on the body of No. 2 and steam belt of No. 3, 22½ in. and on the body of No. 3 26¾ in. Thus No. 1 is hottest, No. 2 is cooler and No. 3 is coolest.

The capacity of the vacuum plant is 2000 bbl per day. The pans are boiled out with fresh water twice per day to remove the salt collected on the sides and tubes, which is not disturbed by the brine circulation. About twice a week the pans are cooled enough to permit men to enter and clean off the scale of calcium sulphate. As the copper tubes are the hottest part of the effect most of the scale collects there. It is removed with boiler-tube cleaners. This plant is considered very successful. The plant has two curing rooms, one 324x132x18 ft. high, and the other 216x132x18 ft. high, with capacities of 150,000 and 100,000 bbl. respectively.

Vacuum Process of Carey Salt Company

The other type of vacuum process is employed by the Carey Salt Company, which also has a grainer-process plant. The vacuum plant is a quadruple effect, the first of the kind ever built. It is comparatively small, having a capacity of only 500 bbl. per day. Its installation was more or less of an experiment, but it has proved so successful that a 1000-bbl. plant is to be installed.

The pans or effects have the form of horizontal cast-iron drums, with hoppers below. They are set side by side, and between each two effects is a hopper-shaped settler. Near one end of each effect is a partition in which are set the 125 copper tubes, 2½ in. by 6 ft., which provide the heating surface. In the new plant the heating surface will be increased. The drums are set with the steam end of one adjacent to the vapor end of the next. The steam in the hot effect has a pressure of 5 lb. The steam is trapped from the steam end of No. 1 to the steam end of No. 2 and mixes there with the steam evaporated from the brine of No. 1. The steam in No. 3 is supplied by steam trapped from the steam end of No. 2 and vapor from No. 2. The same process is repeated for No. 4. The vapor end of No. 4 is connected to a barometric condenser which in turn is connected to a vacuum pump. This pump is used to start the apparatus and is also an aid in removing air from the brine.



VACUUM PAN AND SETTLER OF TRIPLE-EFFECT SYSTEM

No Cleaning Necessary

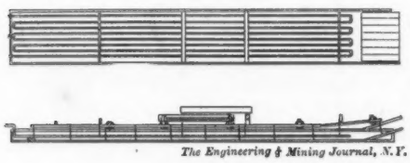
The brine and salt are moved by a centrifugal pump set in the middle of the apparatus on a horizontal shaft extending below the apparatus through its whole length. This shaft also carries four smaller centrifugal pumps, one connected with the hopper of each effect, each agita-

ting the brine in its effect but not passing it forward. The salt carried with the brine exerts a scouring action on the apparatus which keeps it free from scale. The salt produced by this process should differ from the brine only in the removal of water, but no analysis is at hand to confirm this. The fact that no cleaning is necessary is one of the great advantages of the process.

Another aid in keeping the apparatus clean is the reversal of the flow of steam and brine, which is accomplished every 4 hours. Thus effect No. 1, which is at one time the hot effect, becomes the cool one, and No. 4 becomes in turn the hot effect.

As stated before, the brine and salt in the whole apparatus are moved by one centrifugal pump placed in the middle. The salt and brine from No. 1 ordinarily go to the adjacent settler from which the brine and some salt go to No. 2 effect, but they may go immediately to No. 2 effect and so on to the end of the apparatus. Thus the salt produced in all four effects may circulate in No. 4 and the scouring action is considerable. Each effect draws sufficient brine from the brine line to keep the brine in the effect at the proper level.

From No. 4 effect, salt and brine go to the elevator boot from which the salt is elevated to a bin, while the brine goes



GAINER PROCESS PAN

back into the system. The flow of brine from the boot is controlled by a float.

Economical Use of Steam

Each settler has on two opposite sides a narrow chamber partitioned off from the main body. The brine goes into the bottom of one chamber, up to the top, across to the top of the opposite chamber, and out at the bottom. There is then only a surface current and most of the salt settles out.

Every effect and settler is provided with a gage which is constantly watched, and the brine level is controlled by partly throttling the necessary pipes.

No. 1 effect has a vacuum of about 4 in. of mercury, No. 2 14 in., No. 3 19 in. and No. 4 25-26 inches.

This plant gives an evaporation of about four pounds for every pound of steam used, while the grainer process gives very nearly pound for pound.

An analysis of the brine of the district is as follows: Specific gravity, 1.20401; NaCl, 25.506 per cent.; $CaCl_2$, none; $MgCl_2$, 0.0613; $CaSo_4$, 0.4703; bicarbonates of Ca and Mg, none. Some of the salt produced contains 99.97 per cent. NaCl.

The importance of the industry is shown by the fact that in 1907 the district produced 2,667,459 bbl. of salt. The deposits of rock salt, the discovery of which was a disappointment to those who first found them have thus become a source of great revenue to the district.

That the possibilities have by no means been exhausted is shown by the fact that the Hutchinson Chemical and Alkali Company has recently erected a plant for the production of 120 tons of soda ash per day.

The author wishes to acknowledge the courtesies extended by the salt manufacturers of Hutchinson, Kan., and especially by the Carey Salt Company.

Notes on the Construction of an Arsenic Plant

By Harold Howes*

In the construction of an arsenic plant a flue with 7-in. wall of reinforced concrete, a flat roof formed of cement blocks laid lengthwise on T-iron, and the whole covered with concrete represents a low initial investment with maximum efficiency. In England and at Anaconda, Mont., the doors in the flues, except the first three, are of wood, and are but little charred by the heat.

The arsenic that collects on the roof and sides, falling off when heavy, protects the cement from heat. As 75 per cent. of the crude and refined arsenic settles within a short distance of the furnaces, a conveyer for handling same should be one-fourth of the total length of the flues.

After a consideration of many furnaces, the Brunton furnace, in my opinion, stands in a class by itself for reliability and thoroughness. The revolving hearth, usually with a cast-iron frame covered with brick, is heavy; much of the weight could be reduced by light steel construction, a circular angle iron at the edge, and the top surface covered with perforated metal, or a screen, and this surface with 1 in. of clay or magnesia sponge; the furnace in revolving spreads out the charge to a permanent depth of 1 to 2 in., subsequent charges passing over this original layer.

To reduce what very little dust the Brunton furnace creates, and to bring the residue under closer observation, the discharge from the last rake should fall on a spiral conveyer, the shaft of which may be actuated by a bevel gear on the main vertical shaft. The residue would be thus discharged into cars or launders and subject to constant inspection.

In the refining furnace the parting wall as often built takes up valuable space, prevents charging conveniently from hoppers above the furnace and has little to recommend it. The residue from refining furnaces used in America might be advantageously rabled into metal chutes built just under the rabling doors. The residue hoppers, being connected with the crude flue, a down draft takes away the fine dust. All holes and covers are thus avoided in the furnace hearth, and construction simplified.

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The Chromite Deposits of Canada

The mines branch of the Department of Mines, of Canada, has just issued a "Report on the Chrome Iron Ore Deposits of the Eastern Townships," by Fritz Cirkel. In the last few years, owing to the rapid development of the iron and steel industry in Canada, more than ordinary interest has been manifested by the mining and metallurgical public in respect to the Canadian deposits of raw materials and ores, which enter into the manufacture of iron and steel products. To meet the demand for information on these subjects, the mines branch has undertaken to issue a series of reports on the Canadian deposits of the substances which form the basis of the iron and steel industry. Several reports on iron ores and one on tungsten ores have already been issued and the present report is another of this series.

The scope of the "Report on the Chrome Iron Ore Deposits in the Eastern Townships of the Province of Quebec" is best judged by quoting the table of contents, which is as follows:

"Introduction. I. Historical. II. The chrome iron-ore deposits of Canada. III. Mining of chrome iron ore. IV. Dressing for the market. V. Market prices, and status of the Canadian industry. VI. Chrome iron-ore mines: Prospects in Canada. VII. Chrome iron ores in foreign countries. VIII. Origin. IX. Composition of chrome iron ores. X. Statistics and chronology. XI. Determination of the value of chromium. XII. Uses of chromium. XIII. Technology of chromium and its compounds. Appendix II. Experiments with chromite at McGill University. Bibliography."

The report is well illustrated by 11 plates in halftone, from photographs of mines, mills and machinery; and 15 diagrams, maps and drawings, all illustrative of the chromite industry. The author of the report is Fritz Cirkel, to whom it was intrusted on account of his long connection, as consulting engineer, with the chromite and the asbestos industries; the deposits of these two substances in the province of Quebec occur in the same region, and the origin of both is closely connected with the serpentine rocks of the eastern townships. The book is obtainable on application to Dr. Eugene Haanel, director of mines, Department of Mines of Canada, Ottawa.

Mine Explosions As Related to Earthquakes

Evidence Is Submitted to Show That an Earthquake May Cause an Outflow of Gas in a Mine Distant from the Center of Disturbance

BY W. A. SPALDING*

As between the man who pins his faith entirely to coincides for a physical demonstration, and the man who scouts and flouts "the deadly parallel," there is little to choose. Neither has a truly philosophic mind. To deny the value of coincidence is to deny the sequence of cause and effect; to reject all empirical proof. In my article published in the ENGINEERING AND MINING JOURNAL, Feb. 20, 1909, I offered the parallels between earthquakes and colliery explosions simply as collateral testimony, to be taken for what it might be worth; at the same time intimating that I believed a complete and convincing demonstration could not be made in such way. There are peculiar reasons why this is true: An important factor in colliery explosions is chance—a chance that sets the spark to the explosive gas. Against such accidents the preventive measures of mining engineers and mine owners are directed. There may be a sudden and considerable outflow of gas in a mine and yet no explosion, because the preventive measures of inspection, forced ventilation, protected lamps, etc., are effective. Hence, a mine explosion is not to be classed as a natural phenomenon—it comes from a natural condition plus an artificial condition plus an accident.

For the above reason I believe that the problem of the relation of mine explosions to earthquakes must be approached, not from the standpoint of the practical miner or the mining engineer, but from that of the seismologist. In this undertaking the investigator should consider, not so much the earth tremor, which is itself an effect, but the cause or the causes lying behind.

THERE ARE TWO KINDS OF EARTHQUAKES

Earthquakes are divided into two classes —volcanic and tectonic. The cause of volcanic earthquakes is believed to be an explosion of gas or steam which forces a vent through the crater. Before this explosion, and at the instant of its occurrence, there must be a tremendous back pressure from the inclosed gases or steam. How far such back pressure may ramify through fissures in the crust of the earth, or through compression of the crust, no man can tell. If anybody questions the probability of such action, let him try to imagine a cannon capable of firing vertically a projectile of 100 or 1000 tons *with no recoil.*

Tectonic earthquakes are believed to be due to stresses or strains set up in the earth's crust. These are attributed to internal or external causes, or both combined. The stress or strain may be progressive, from the contraction of the earth's crust in cooling, from the shifting of loads on the surface through erosion and water action, from internal pressure, or the failure of internal support. The external causes are either periodic or sporadic, being attributed to tidal pull, due to the moon and the sun separately and in conjunction and opposition; to sudden variations in barometric pressure, etc.

If tidal strain is effective upon land surfaces, as it is upon water surface, then, when the gravital influence of the moon and the sun are combined at conjunction and opposition, there are two areas of maximum strain which pass around the earth in 24 hours, and practically every portion of the earth's crust must be put to the test. It is this tidal strain to which seismologists attribute an established increase of frequency in earthquakes at the syzygies.

STRESSES ON THE EARTH'S CRUST

Whatever the cause of these stresses or strains in the earth's crust, it is certain that the region of least resistance or greatest pressure or strain is selected for fracture. Thus the earthquake is localized. The fault represents a former line of cleavage reëstablished, or a fresh break. The pressure is often sufficient to produce a slip in the cleavage and, on either side of that line, the earth's crust may be elevated or depressed, or suffer a longitudinal thrust. The shock is most violent at some point on the line of the fault, and decreases by regular graduations with distance from the epicentrum, so that the area perceptibly affected may be defined by an inclosing isoseismic line. The tremor in the earth is simply a vibration imparted to the crust by a shock; the shock of sudden breaking, violent friction, upheaval or depression, and the energy of this vibration is gradually converted and dissipated. Thus the area of violent disturbance is restricted, and the earthquake is, in a sense a local phenomenon. But seismographs inform us that minor tremors from such a disturbance pass entirely around the earth, and are recorded at points thousands of miles distant from the center. While the area of pronounced vibration is localized and circumscribed, it is not reasonable to assume that the area of stress or strain which preceded and caused the shock was thus localized and circumscribed. Since, for reasons given, seismic action must be selective, there is no telling how much of the earth's crust may have been traversed and put to the test before that one weak point was encountered. There are notable cases on record—like the Lisbon earthquake in 1755, the New Madrid earthquakes in 1811-12 and the great earthquake central in the gulf of Mexico in 1907—when every continent, so far as known, was subjected to more or less violent disturbance, thus showing presumably that the whole crust of the earth was subjected to simultaneous stresses and strains, and that many weak points were disclosed.

On the desk before me are two interesting objects: a sponge and a small bellows. The sponge is saturated with water; all the little ducts, channels and interstices are filled. I squeeze the sponge vigorously and the liquid runs out in a stream. The bellows, expanded, is filled with air. I compress the sides and the air flows out through the nozzle. Now, the earth's crust is similar to the sponge, inasmuch as it is honeycombed with caves, pockets, seams and fissures; it is somewhat like the bellows inasmuch as these openings are filled more or less with gases. Is there anybody to hold that the earth's crust, when suddenly squeezed, would not act mechanically just as the sponge and the bellows do? It is perfectly apparent that, under stresses which may traverse a considerable part of the earth's crust before a seismic disturbance is precipitated, these contained gases would be driven to and fro along the line of least resistance in an effort to escape the pressure.

UNDERGROUND CHAMBERS ARE FILLED WITH GAS

A mine is an artificial pocket in the earth. At a time when gases are driven forward by compression—when the earth's crust is flexed, buckled, broken by seismic action—what assumption is more natural than that they should find exit through seams and fissures to this place of least resistance?

Here is the whole argument in a nutshell, and it is incumbent upon those who dispute it to indicate wherein it is unreasonable.

That there are times when, without any apparent local cause, underground chambers become filled with gas. Whether such gases are explosive or not, whether it requires the admixture of air or coal dust to render them explosive; whether

*Los Angeles, Cal.

they are actually exploded or not, is entirely foreign to the argument. We are simply tracing natural causes which supply the conditions favorable to accidents of this sort.

Under the hypothesis here set forth, the accumulation of gas in a mine is even more likely to occur in advance of an earthquake than concurrent with it or following it; the actual time of explosion is determined by accident, and due allowance must be made for that uncertain factor.

That the mine in which an explosion occurs is far removed from the locality of a proximate or concurrent seismic disturbance does not discredit the theory of relationship, in view of the wide range of stresses and strains previously discussed.

Results of Investigations in Japan

Japanese seismologists, who are among the most careful, methodical and thorough investigators in this field, and who have the best opportunities for investigating, have thought it worth while to make a series of experiments on wells, to show the fluctuations in water level. They have found a sympathetic relation between such level and barometric pressure and also with the ebb and flow of tides. As there can be no direct connection between fresh-water wells and the body of the ocean, this last factor must be resolved into earth-pressure, due to the rise and fall of tides, or tidal strain. In a monograph on the "Daily Periodic Change of the Level in Artesian Wells," by Prof. K. Honda, published in the 18th report of the Imperial Earthquake Investigation Committee, he says:

"Hence we may infer that in every artesian well, the level of the water is held in position by the equilbrium of two pressures—the atmospheric pressure and the underground pressure. If one of these pressures undergoes a change, a corresponding change of level is produced."

As the title of the monograph implies, there is a rhythmic variation in the pressure of artesian wells. This, Professor Honda shows in a series of curves.

The relationship between ocean tides and phases of the moon is so thoroughly established that mention of it is only necessary to connect the argument. Again, phases of the moon have been associated with frequency in earthquakes. Prof. F. Omori, of the Japanese Commission, found several maxima in the activity-curves for three stations in Japan. By smoothing these curves he obtained two distinct maxima in each curve, which occur about the 5th and 17th hours of the lunar day, the time beginning with the upper culmination of the moon. These positions of the maxima nearly coincide with those of high water. Thus we have five classes of phenomena connected in sympathetic relation: phases of the moon, earthquakes, tides, subterranean pressure and the level of water in artesian wells. It is perfectly plain, then, that there is a relationship between earthquake frequency and subterranean pressure, and this might be shown by comparison of curves as readily as any other two of the relationships mentioned. If there be such a periodic ground pressure affecting the level of the water in wells, why should it not also affect the pressure and flow of a rarer medium—gas—in subterranean channels? If this be a process carried on with a daily periodicity and monthly fluctuations, why should not a violent convulsion in the earth's crust have a much more pronounced effect?

Bearing directly upon this argument and supporting it in a striking way, I beg to repeat the addendum to my first communication to the Engineering and Mining Journal.

The following Associated Press Dispatches explain themselves:

"Well Forecasts Earthquake

"Beloit (Wis.) March 19, 1908. The roaring well on the Charles Lathers farm northeast of Beloit, sounds from which preceded the San Francisco disaster, is again emitting rumbling noises and a strong wnd from its cavernous depths. It is asserted that this well began roaring a few weeks before the San Francisco earthquake, and ceased at exactly the hour of the quake."

"Prophetic Well Tells of Earthquake

"Beliot (Wis.) March 27, 1909 (Exclusive Despatch). The famous 'roaring well' has again made good. March 19 it was found that the phenomenon, on the farm of Charles Lathers, northeast of Beloit, Wis., was active. The well roared for several weeks before the great earthquake at San Francisco, and the curious sound of rumbling, together with wind from the mouth of the well, ceased at the precise hour when the shock struck the California city. On a day, a little over a week ago, when the well resumed its clamor, residents of Rock county predicted a calamity. Yesterday it came in Chilapa, Mexico."

The following letter confirms the Associated Press reports and gives some additional details:

"Beloit, Wis., April 14, 1908.

Mr. Chas. Fletcher,

Dear Sir:

Your letter with regard to 'Roaring Well' just received. In reply I wish to say that about two weeks before the San Francisco earthquake, wind started to blow out of the well with such force as to cause quite a noise. This continued for about two weeks and stopped on the day of the earthquake. It also blew two days just before the Mexico earthquake. We have never had our well examined, but it seems strange that this should occur just before the earthquake. The well is 110 ft. deep, 40 ft. is dug and a 6-in. iron tubing is driven down 70 ft. The water is as good as any, pure and clear. The air that blew out of the well was pure cold air; no smell or taint of any kind. Hoping that this will be satisfactory, I remain

Yours, etc.,

"(Signed) Chas. F. Lathers."

L. F. Rosenthal, postmaster of Beloit, says, in response to an inquiry:

"The public in general take it for granted about the roaring well. Mr. Chas. Lathers is a well known and a very prominent farmer. Whatever he has to say can be relied upon.

"Beloit, April 7, 1908."

Beloit, Wis., is far removed from San Francisco, yet it appears that there was some sympathetic connection between the roaring well and the earthquake in the latter place, April 18, 1906. Again, a still greater distance intervenes between the roaring well and the City of Mexico, yet the phenomenon is repeated March 26, 1908. Such sympathetic action can only be accounted for on the theory of a general stress upon the earth's crust preceding and concurrent with seismic action.

If, under general seismic stress, air from subterranean sources rushes through the depths of a well, why may not gas from subterranean cavities rush into the chambers of a mine?

A Recent Instance

Since the above article was prepared the following report comes from France:

"Paris, June 14. Cable to the Associated Press—Three new earthquakes yesterday swept Provence from the River Var to the Loire. The disturbance was chiefly in the mountain regions, where several deaths are reported.

"Nature sent curious forewarnings of the disaster. At Bargemon, five minutes before the shock, all the electric lights went out, the church bells rang violently and water in the wells and fountains grew hot, so that the inhabitants had time to flee into the open.

At Fiminy the coming earthquake was announced by thunderous reverberations in the adjacent mines, followed by the explosion of firedamp, but fortunately the mines were empty on account of the Sunday holiday. The seismographic machines did not record the disturbance until the exact moment of the shock."

The most promising outlet for Transvaal coal seems to be India, where already large shipments are being despatched. The price of Transvaal coal landed at Bombay is about $5 per ton, which is less than the cost of the local product, which is considered inferior.

Considerable quantities of iron ore from the Tayeh iron mines in China are exported to Japan.

The Flushing Problem in the Anthracite Region

SPECIAL CORRESPONDENCE

One of the most pressing of the scientific problems confronting mining operators, mining experts and the people living on the surface of mining lands is the prevention of the caving in of the surface, either after the mine has been exhausted, or when the process of "robbing the pillars" begins. The problem is practically confined to what is known as the upper regions of the anthracite-coal measures, where the veins run horizontally. It does not affect, or only to a slight degree, the regions in which the saddle veins exist. In this connection exact mining terminology will not be strictly adhered to. It is a problem that affects the people living on the surface of the mines, exhausted or exhausting, although of course the railroads tapping the anthracite regions are so closely identified with the industrial prosperity of these populous communities that anything affecting the efficiency of the one, or disturbing its equilibrium, must necessarily and inevitably react on the other.

It may be, and, in fact, must be admitted at the outset that the amount of property injured by mine caves has been, up to the present moment, comparatively small. On the other hand, those who have suffered most and who will suffer in the future in a relatively increasing degree are industrious, thrifty miners who have purchased little plots of land of their own and who have erected homes on them.

Another important circumscription of the danger arising from mine caves is that while they are by no means uncommon, they are for the most part confined to surface veins. On the other hand, it must be taken into consideration that with the progressive exhaustion of the coal lying in horizontal beds, the pillars which are in a marked degree the only approximate support of large tracts of land, built over, urban or suburban, will disappear altogether, and if some substitute is not brought into requisition, the danger from mine caves in the future will be formidable indeed.

Take for instance the city of Scranton, with a population of nearly 200,000, with many great industries developed in connection with or independent of the mines. The foundations of Scranton are little better than a huge rabbit warren. These catacombs are for the most part the result of mining of deep veins, in the central part of the city at least, and they have been exhausted for such a long time that there is no apprehension in any well-informed quarter that subsidences will ever take place there short of a seismic cataclysm. But this state of affairs does not obtain in the suburbs of Scranton, in Pittson, in Wilkes-Barre and other sections where mine caves are occurring every day, not infrequently with disastrous results to property.

At least 20 per cent. of the unmined coal in sight consists of coal pillars. In some mines, it constitutes as much as 50 per cent. As a matter of fact it is the most valuable and easily mined coal in the mines. It may be assumed that a pillar is coal throughout, pure coal in fact, so far as marketable coal may be said to be purely a constituent carbon. These pillars constitute an enormous reserve of coal to which the operators will increasingly turn their attention when the bedded coal is exhausted or nearly so. The process of depleting the mines of pillars is called "robbing" locally, and is a misapplication of language to a perfectly legitimate phase of industrial exploitation. It has found currency outside of the mining regions and passes in its application for what it is not in any sense. This invariably happens when an extensive cave occurs and the fact is telegraphed far and wide as something ruthless and illegitimate.

FLUSHING THE MINES

To counteract the effect of pillar robbing and natural exhaustion of the veins, the "Scranton system" of flushing the mines has come into general operation, not only in the upper sections of the anthracite regions, but it is in general use in Germany, particularly in those sections of the mining regions that run under the bed of the Rhine. The flushing in simple terms consists of replacing the coal and rock by some foreign material. Here then is the difficulty. Not 10 per cent. of the material taken out of the mines can ever be returned to it. When the "Scranton system" of flushing was first mooted by Samuel McEachen as far back as 1878 or 1880, the culm dumps were unsightly excresences, standing out in hideous insularity all over the mining regions. Neither Mr. McEachen nor any other person realized their intrinsic value, or the vast treasure house of coal that they contained.

It was only within the last 13 or 14 years that the potentiality of the culm dump became apparent and their realization into property and their capitalization in the financial world became an actuality. Culm dumps are disappearing with incredible rapidity. After the culm has been washed, the residuum is almost insignificant. There is a considerable amount of rock or bony matter in every mine, and this is not taken to the surface, or at least very little of it. This is built into the gangways whose chambers have been exhausted, leaving a large space to be flushed in. Taking any individual mine where such processes are going on, effective work can be accomplished by flushing.

OPERATORS ARE NOT COMPELLED TO FLUSH THEIR MINES

There is no legal obligation on any coal operator to flush his mines. That matter has been decided by the Supreme Court of Pennsylvania. However, there is a moral obligation, but this of course extends only so far as the individual operator or coal company thinks it well to assume. Within the past few months, the Ontario Western Company has installed a system of flushing at its Pine Brook colliery, which if it proves successful will eventually result in giving a solid foundation to the whole of the central, or business, section of the city of Scranton. The "Scranton system," so far as it has been developed, is probably seen in its most perfect form at this colliery. The flushing of the mine in its practical application is under the immediate direction of Superintendent W. L. Allen and Daniel Young, the inside foreman. The initiative and general direction of the work is under the superintendence of John R. Bryden, general superintendent of the Scranton Coal Company, the Ontario Western controlling the mines of this corporation. The location of the Pine Brook breaker is right in the heart of the city. It is a new breaker and one of the largest in the northern section of the anthracite region.

The breaker has a capacity of 750 cars a day. The seam which is in process of flushing is known as the "Clark vein." It is 171 ft. beneath the surface. The Clark vein runs all through the Lackawanna valley, and of course only a small section of it is in the process of flushing. The hight of the vein from roof to floor averages from 11 to 12 ft. As an experiment, the work will be watched with the greatest interest. The flushing has been carried on during the course of the last 12 months. It is estimated that the part of the vein under the business section of the city will be flushed in another year; that is to say, the area contemplated in the present project.

Flushing is slow and expensive work. If the operators do not undertake the work, the State eventually must. I do not see why the State should not assume the responsibility; it has largely profited by the exploitation of the coal lands. Pennsylvania would not be the great industrial commonwealth it is, without its enormous coal measures, and, after all, the amount of void that has to be filled up in the mines to secure property is comparatively small. At any rate it is useless to try to induce the operators to do much more than they are doing in this way.

The material for flushing is not easily obtained. Any material for flushing purposes must be pulverized, and this necessitates a crusher or pulverizer for that particular purpose. When the stuff, put in wet, congeals to a certain consistency, it consolidates as hard as rock, and may be

left to sustain its reputation for solidity without fear for eternity.

Flushing Is Begun at the Highest Point

The flushing is begun at the highest point in any particular section of the mine, the water flowing by gravitation to the lowest point selected and carrying in suspension the silt and pulverized rock with it. To check this flood at any particular point, "batteries" are erected. These "batteries" are heavy planks placed against props which are embedded, top and bottome, into the roof and floor, respectively, so as to hold them in place against the pressure of the flood of refuse which is carried against them. Interstices in the planks afford an outlet for the water, which sweeps through, rushes down to the foot of the shaft and is there pumped back to the surface and carried into the Lackawanna river, which in this instance is only a short distance from the mine. It is, however, at the opening of the "slush" line that the main interest lies. The coal-black stream issues from the 6-in. flushing pipe with the force of a hydraulic battering ram, sending the stream of culm, boiler ashes, etc., fully 15 ft. from the nozzle of the pipe, to whatever point it is directed. So solid is the packing that after a night's drying it is as firm as concrete that has set. The Pine Brook people are flushing in stuff at the rate of 500 tons a day. This may appear to people who are familiar with large engineering operations as insignificant. But it must be taken into consideration that the work is exceptionally tedious and expensive; that it is a dead loss to the company, so far as they are likely to reap any material benefit from it.

Fighting a Coal Mine Fire

By Frank Lynde

A mine fire is always a cause of intense anxiety to the operator. More than a generation ago, at the Greenwood mine, near Tamaqua, Penn., a workman hurrying out of the mine, after his day's work, allowed his naked light to touch the dry timber in the manway. The little spark left on the timber began to glow and finally the prop caught fire from it. The following morning, when the miners attempted to go underground, it was found that the coal was on fire.

The officials decided to flood the workings, and water was turned into the shaft, but without effect. The fire had gained such headway that it was beyond control. The mine was soon abandoned. The coal, which was about 60 to 75 ft. in thickness, was saved below the water level by many millions of gallons of water, but the part of the seam at or above the water level was badly affected by the fire.

Method of Attack

The company (Lehigh Coal and Navigation Company) was anxious to mine the coal below the water level; in order to do this, the fire had to be extinguished. For the last 50 years engineers and superintendents in the anthracite field have tried to quench the fire, but without results. In 1906 the company proposed to employ modern methods to extinquish the coal, at an estimated cost of about $2,000,000 and the work of fighting the fire was reorganized in the fall of that year.

The plant consists of a boiler house, four 100-h.p. boilers, built on the bank of the Schuylkill river, together with two large pumps having a capacity of 24,000 gal. per min. The water is pumped through a 10-in. line for a distance of three miles up the mountain. On top of the mountain a trough is built into which the water is discharged and there mixed with culm brought by the carload from a culm bank two miles away. The mixture thus formed is introduced into the mine through 6-in. holes drilled at various angles and places. It has been calculated by the engineers that in two years, approximately two billion gallons of water, besides the culm, will have been pumped into the old workings. The results so far show that the method employed is effective.

The Real Value of Steam Coal †

By D. T. Randall*

In general it may be said that a furnace may be designed to burn almost any kind of coal with good efficiency, and that the real value of a coal depends very largely upon the number of British thermal units which it contains. Tests which have been made at the Government Fuel Testing Plant seem to indicate that the most important thing to be considered in a coal is its heating value. Following this, the size of the coal may be considered as next in importance, and when the moisture, volatile matter and ash are widely different they must also be considered. The results of more than 400 boiler tests at the Government Testing Plant show that the average drop in efficiency for a range of coals between 14,000 B.t.u. and 10,000 B.t.u. is only about 6 per cent.

This difference is due to the combined influence of the size of the coal and the moisture, the volatile matter and ash in the coal. It will be seen from these figures that the probable influence of any of these constituents is not as great for hand-fired furnaces as it is often thought to be. With certain boiler equipments in which a considerable overload is necessary at times, the effects of these constituents may be much more important owing to the reduction in capacity which may be obtained, and it is for this reason that when coal is selected for a given plant it is important that the coal supplied should not vary greatly from time to time. Otherwise the fireman may have serious difficulty in maintaining the capacity required, and in burning the coal with good efficiency.

A Close Correspondence between the Heating Value of the Coal and the Water Evaporated

With a furnace which is well designed, there should be a close correspondence between the heating value of the coal and the water evaporated. Small variations in moisture, volatile matter and ash should make little if any difference in the efficiencies obtained.

The size of the coal may influence the results to a serious extent. Small sizes of anthracite coal pack together closely and strong drafts are required to burn them. This results in holes in the fire and a leakage of air in the boiler settings. The loss is often estimated to be at least 10 per cent. This is also true of many of the bituminous coals. Other coals which coke readily, forming a loose bed of fuel, do not show much loss, due to the presence of fine coal, except such as is so small as to be carried off from the grate by the draft.

With any character of coal there may be a loss of fine coal, due to sifting through the grates. That this loss may be large is well known. The carbon in the ash is an important item in determining the losses in a boiler room. In many plants care on the part of the firemen has reduced this loss to the equivalent of 2 and 3 per cent. of the fuel fired.

Occasionally owners of power plants have purchased for testing purposes a coal of higher grade than they usually furnish for the boiler furnaces. The results obtained have often been disappointing and without further investigation they have declared that the plan of purchasing coal on the basis of its heating value is at fault and that corresponding results cannot be obtained from the higher grade coals. On the other hand, it has happened that others have tried coals of lower heating value than the coal regularly burned in their plant and they often find a greater drop in the evaporation than they expected. This has led many people to believe that there is a great difference in the value of coals for only slight variations in the composition.

Boiler tests are a rather crude method of comparing coals especially if the fireman is not accustomed to burning the coal to be tested. A chemical laboratory test is conducted under conditions which may readily be duplicated and the results are therefore more reliable than boiler tests.

†Abstract of paper read before American Society for Testing Materials.

*Engineer in charge, Fuel Engineering Department, Arthur D. Little Chemical Laboratory, Boston, Mass.

The averages of a number of boiler tests on each coal on which the combustion is fairly good in all cases should show results which agree quite closely with the chemical results on the coals provided they are of the same general character. If they vary in composition a slight reduction in efficiency may be expected for the coals high in moisture, volatile matter, and ash.

Apparatus for the Detection of Fire-Damp

In view of recent discussion as to the manner in which examinations are made to detect the presence of firedamp, W. C. Blackett has devised an apparatus (*Trans.* N. Eng. Inst. Min. and Met., June, 1909) by means of which a high lamp flame may be used. He points out most emphatically that small percentages of firedamp can be seen quite as well, and even better, with a lamp flame that is somewhat high and shows a small white light, than with a flame which shows only a blue light. It is necessary, however, that the white light should be shielded from the eye, and, if this is done, a very much longer cap is to be seen than with the small flame which shows only blue; with 3 per cent. gas it is much more than twice as long.

Practical men have always recognized this, and it is a common occurrence to shield with the thumb the white speck of light, and so more easily observe any cap.

This is effected in Mr. Blackett's device by the fixing of a small shield inside the lamp (about ½ in. from the flame) either to the pricker or to the wick-pipe. This, of course, allows of the use of a higher flame, and so reduces the risk of the light being extinguished, and, at the same time, proves more effective in the detection of firedamp.

In the detection of gas Mr. Blackett has failed to find any advantage in the use of blue glass; but a magnifying glass, whether blue or clear, he has found helpful. Anyone who is accustomed to read with spectacles should use them also when examining for gas.

It has also been found that if the inside of a suitable portion of the lamp glass be ground, the reflection which sometimes interferes with proper observation of the flame will be avoided.

Colliery Notes

An air compressor should be cleaned and the valves inspected at least once a week. It is held by many that it is dangerous to run kerosene through the air end on acount of the temperature developed. This, however, may be safely done if the machine is run for a while without load, thus allowing the kerosene to be carried out before any heat is generated.

Practice differs in regard to the manner of carrying the air pipe through the mine; some companies suspending it overhead, and others laying it along the floor of the drive beside the track. The overhead system is easier to put up, is less liable to rust through, and is easier of access for connections, repairs, or inspection. The pipe on the ground requires no plugs or sprags for its support, but gets buried in the mud and is liable to spring out against the rails and interfere with the passing of the cars.

With reference to the kind of combustion tube that is best to use in the analysis of coal, some chemists prefer a porcelain tube rather than one of glass. This preference is based on the fact that the initial cost of the porcelain soon repays the outlay because it can be used over and over again. It is essential also that the gases from the combustion tube first pass through the calcium chloride, then through the potash, not *vice versa*.. The calcium chloride should be freshly dried before use.

Arrangements have been completed for the opening of a new colliery at Thorne Moor in Yorkshire, England. This undertaking will rank as one of the greatest achievements in coal mining; preliminary investigation has shown that this new mine will be the deepest and largest in Yorkshire. Sinking operations have been begun, and it is calculated that the coal seam will be reached at a depth of 2760 ft. The contractors already know that at shallow depth the shaft will encounter quicksands and a large volume of water. This difficulty will be overcome by using the freezing process and tubbing. Each of the shafts at this new mine will be 22 ft. in diameter inside the walling. It is estimated that when coal is reached and development started, there will be employment for 4000 men.

The problem of wiring for lighting circuits underground may be safely reduced to a selection between two possible systems. The first system is the open-type wiring, the wires being supported on porcelain insulators. The second system is that where the wires are contained in a strong steel smooth-bored pipe, which is generally protected from corrosion externally, and usually has an insulating internal casing. In dry places where the roof is good, it is possible to use the first system, known as open wiring; the wires are then under constant inspection and they can be readily renewed when necessary. In damp places, or at points, such as haulage-road crossings, where damage is likely to occur, protected wiring is to be preferred. Wherever steel piping is used it should have screwed joints suitable to provide mechanical strength and electrical continuity. Such piping also must be permanently earthed.

Now that we have convinced ourselves that the available supplies of coal are sufficient to keep us warm and to provide for all business development in coming centuries, several scientists have thought it best to call our attention to the fact that for every ton of coal we burn, 300,000 cu.ft. of air is used up and rendered unfit for breathing. These investigators claim that it will be only a few hundred years at our present rate of increase in coal consumption, and incidentally oxygen consumption, until all the atmosphere on the earth's surface will be rendered incapable of sustaining life. It appears, therefore, that at best we only have a choice between two evils; either we must freeze to death or be stifled by a lack of proper air. It is to be hoped that some other scientist will arise and comfort us by stating that the carbon dioxide, which the present consumption of coal is returning to the atmosphere, will so greatly stimulate vegetable life, that the rate of growth of plant life will be materially increased, thus preserving our atmosphere by removing the poisons and preventing the final extinction of human life.

An American company is operating and developing a coal mine in Spitzbergen, adjacent to Advant bay. The capital stock is largely owned in Pittsburg and New York. This is the most northerly coal mine in the world, and will be operated this year during the winter months for the first time. This operation is situated about 580 miles north of Hammerfest, Norway, the most northerly incorporated city in the world. At this mine, there are three months in the year when the sun never sets (May 15 to Aug. 15). Six months in the year are passed in practically complete darkness. The greater part of the output from the mine is sold to the whalers; a small part of the production is shipped to Norway. The company can practically command its own price for the fuel, as it is the only coal operation in the region. At present, the only power is that furnished by horses; however, an electrical plant is to be put in next year. The coal seam is reached by a drift. The coal is hard and of fairly good quality. During the summer months the mine is worked 24 hours each day, and the daily output has averaged about 500 tons. Absolutely nothing grows in this region and practically no vegetation exists. All food for the men and horses is shipped in from Norway. Navigation is only possible three months in the year, so all food must be brought in during these open months. Spitzbergen is now owned by no country; however, it is believed that when the question of ownership of this island is decided by the Hague Peace Conference next year, Norway will be given possession. It is understood that the American company has assurance from the Norwegian government that the capital invested will be protected, even should the island of Spitzbergen revert to Norway. About 60 miners are employed.

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The Copper Statistics for August

The American statistics for August prove the deduction that we made several months ago, viz., that domestic consumption had not gained so much as the deliveries indicated and that manufacturers were transferring a part of the accumulation to their own yards. Actual consumption received no setback in August. On the contrary it forged further ahead in all probability, evidence as to which is afforded by important collateral statistics. This being so it is, of course, preposterous to believe that consumption jumped from 47,546,000 lb. in April to 61,163,325 in May, then to 75,520,083 in July, only to fall off to 59,614,207 in August. Rather is it clear now that the deliveries in May-July were in excess of the consumption, and that although the world's uses for copper are increasing steadily, production is still increasing more rapidly.

This condition would theoretically create a downward tendency in the market. Such tendency appears, however, to be practically neutralized by the fact that the accumulation of stock as a whole is in strong hands, which are contemplating carrying it until consumption overtakes production—or more nearly approaches it—and are assisted by the continuance of low rates for money. The copper market seems to be therefore substantially in the condition of equilibrium, and for the present subject only to small fluctuations that arise from ephemeral causes. There is so much copper to be sold that a bull movement cannot be successfully inaugurated, and on the other hand the producers are neither disposed or compelled to sacrifice their holdings.

A Word of Caution as to the Porphyry Coppers

The success of the Utah Copper Company and the Nevada Consolidated is having the natural result of stimulating interest in the newer companies that have been organized to exploit similar ore deposits, and there will be undoubtedly increased speculation in their shares. In this connection it is worth while to advise some caution. Among the newer enterprises there are some, particularly Miami and Ray Consolidated, which will undoubtedly repeat the successes of the older companies. Their development has been carried on so cautiously and so thoroughly, under the most competent engineering direction, that the knowledge as to their ore reserves affords strong ground for this expectation. Giroux also is one of the older and well developed properties, as to which we shall say a word later. The other porphyry enterprises, such as Gila, Inspiration, Ray Central, and Chino, are very new, and as yet comparatively little is known respecting them. Utah Copper Company and Nevada Consolidated were upward of five years in being brought to maturity, and a more or less similar time is to be expected in connection with all such enterprises. This is one condition that should be well considered by investors.

Another condition that should receive careful attention is the difficulty of determining accurately the probable yield of the ore when the exploration is done in a hasty way. It is comparatively easy to make a quick development of a large tonnage of ore in these immense blanket deposits, especially when they are so situated that the existence of ore can be proved by drilling. But drilling as commonly conducted is apt to be a guide only as to the existence of ore and utterly unreliable as to the grade of the ore. However, it may be conducted under certain conditions, with the exercise of extraordinary intelligence and care, as has been apparently the case at the Ray Consolidated, so as to afford what are apparently reliable results. At least, it is said that the sampling of underground openings that have connected with drill holes at the Ray Consolidated have closely confirmed the assay results obtained from the drill holes. Admitting this to be so, it shows only that drill exploration, in order to be reliable, must be conducted with the same engineering skill as at the Ray Consolidated. Everyone knows of drill explorations elsewhere that have led to great disappointment as to the grade of the ore when the latter has been actually extracted.

The most doubtful factor in connection with the newer porphyry mines is the grade of the ore. In nearly all cases the grade is conceded to be low, anyway, and the decrease of only a few tenths of a unit increases greatly the cost of production per pound of copper. Another doubtful factor that has the same effect is the percentage of extraction in milling. These essential factors can be reliably determined only by extensive underground

openings and elaborate mill tests, such as were made in connection with the Utah Copper Company, Nevada Consolidated, Miami and Ray Consolidated, all of which requires a good deal of time.

We referred above to the Giroux company, which is among the older porphyry mines; indeed, its exploitation began almost coincidently with that of its neighbor, the Nevada Consolidated. Giroux is still, however, a long way from the producing stage. This company, according to its report for 1907 had developed approximately 4,000,000 tons of porphyry ore of grade similar to that of the Nevada Consolidated and about 350,000 tons of smelting ore, averaging 6½ per cent. copper. Since the acquisition of the control of this company by Cole & Ryan attention has been chiefly directed to the development of the high-grade ore in the Alpha shaft, and it is said that the resources now disclosed there warrant the erection of a large smelting plant, but no authoritative statements have been made. This ore apparently occurs as chamber deposits in limestone, and is of entirely distinct character from the porphyry ore of Ely. It will be remarkable if Ely becomes famous for both kinds of ore deposits in such close proximity as is the case in the Giroux property. But whatever may be the glittering possibilities of Ely in this respect they do not confer any merit upon the numerous wildcats of that district, whose property is outside of the mineralized zone so far as present geological knowledge extends, the booming of which is now being resumed upon the strength of the substantial companies of the district.

Shooting off the Solid

Undoubtedly the most important recent legislation affecting coal mining in the United States is the prohibition of shooting from the solid by the State of Pennsylvania., This legislation, however, was only half-baked, and left it optional with the State Department of Mines as to whether the law should be interpreted strictly and enforced. The result was that the Department of Mines entered into an agreement with the operators, permitting a continuance of the practice under certain conditions. We shall not spare the time now to comment upon the ineffectiveness and absurdity of this kind of legislation. It is more important to remark that the Department of Mines has lately withdrawn from its agreement insofar as the Connellsville region is concerned and has declared its intention to enforce the law strictly.

The statement of many coal operators that it is unfair to prevent solid shooting in certain states or districts and at the same time permit operators in adjacent and competitive fields to follow this dangerous practice, is an unworthy excuse. It would, of course, be best if we could have simultaneous action in this respect by all of the coal-producing States, but under our conditions such is impossible.

Shooting from the solid should be condemned from a standpoint of economy as well as from that of danger. It is useless to expect miners to remedy this evil themselves, for strange to say, our underground workers seem to be less concerned with the abolition of bad practices than is the operator himself. The very nature of the coal miner's work has made him a gambler of the worst type, for it is his own and the lives of his brother workers that are at stake. It is to be hoped that Mr. Roderick, the chief inspector of Pennsylvania, will follow his recent order by another ruling prohibiting solid shooting in all of the mines of Pennsylvania, and it is also to be desired that the chief mine authorities in other coal States will see their duty and do it.

Gold Production in Australasia

The return of gold production in the States of Australia and the Dominion of New Zealand for the first half of the current year show only a small change from the first six months of 1908. The gold output, as given by the official returns, is found in the table below, in which only the comparatively small returns from South Australia and Tasmania are estimated; the figures are in ounces of fine gold.

	1908.	1909.	Changes.
West'n Australia	827,017	782,069	D. 44,948
Victoria.....	320,677	314,224	D. 6,453
Queensland.....	214,861	204,191	D. 10,670
New South Wales	112,064	90,067	D. 21,997
Tasmania.... ...	31,000	29,500	D. 1,500
South Australia..	7,250	6,900	D. 350
Commonwe'lth	1,512,869	1,426,951	D. 85,918
New Zealand....	237,297	223,134	D. 14,163
Total, oz.....	1,750,166	1,650,085	D. 100,081
Total value....	$36,175,931	$34,107,256	D. $2,068,675

The total decrease for the year was 5.7 per cent., the greatest proportional reduction being 15.1 per cent. in New South Wales, and the smallest, 2 per cent. in Victoria. The total falling off is proportionally larger than in 1908, the decrease that year from 1907 having been only 2.7 per cent. The maximum production reported for Australasia in recent years was 4,315,759 oz. fine gold in 1903. The output for the first half-year therefore shows a decrease of over 23 per cent. from that year.

Several causes have combined to produce the reduction this year as compared with last. In Western Australia it is a continuation of the story of several years past: general activity, but a decrease in the grade of ore at the larger mines. No new discoveries have been made and no new districts opened to make up for the smaller output at Kalgoorlie and elsewhere.

In Victoria the old districts of Bendigo and Ballarat kept up their production, but a loss in some other districts brought about the small decrease. In Queensland the smaller output was the result chiefly of lower returns from the Charters Towers district, and of a little smaller recovery of gold from the Mount Morgan copper. The large decrease in New South Wales was due to suspension of work at several mines, and to the lack of success of several of the newer dredging propositions. In New Zealand the work at the Waihi and other large mines kept up well, and the decrease this year was due entirely to smaller returns from the gold dredges. For several years past, Australia has opened no new districts. Prospecting and discovery have been wanting in the goldfields, and new enterprises have been chiefly in copper and tin. This tendency seems to continue in the current year.

The cement-manufacturing companies of Canada have completed the organization of a "trust," or combination, which includes practically all the large plants in Quebec, Ontario and Manitoba. Canada is well supplied with materials for cement making, and the consumption has increased rapidly in recent years.

So far the new census appointments appear to be good. As compared with the administration of Mr. North there is a very great room for improvement in taking the census of the mining and metallurgical industry. The last report was about as useless an aggregation of figures as can be conceived.

Gypsum on Cape Breton Island, Nova Scotia

By John Tyssowski

For a number of years New Brunswick, southern Nova Scotia, and more recently Cape Breton have supplied a large portion of the gypsum consumed in the United States. Owing to the reduction in the tariff on gypsum imported into this country, which reduction is from 50 to 30c. per ton on the crude, and from $2.25 to $1.75 per ton on the ground or calcined material, there is no doubt but that added interest will be given to this industry in the localities mentioned.

Nature of the Deposits and Minerals Produced

The gypsum produced in Nova Scotia and New Brunswick is of a superior character. It is of a fine quality, contains little iron or other substances which affect the color, and also carries small quantities of magnesia, or of calcium carbonate. The deposits in this region are advantageously situated in many cases directy on the seacoast, and in harbors where shipping facilities are good, or at least close enough to tidewater so that the product of the quarries can be cheaply loaded on ships.

Many of the deposits are of great extent and can be quarried at a low cost. Labor is comparatively cheap in these provinces, common labor bringing only from $1.35 to $1.50 per day. Owing to these advantages of low labor costs and situation, the operating companies are enabled to market their product at a profit for about $1.10 to $1.25 per ton f.o.b. shipping point. The freight charges to New York, when handled in schooners or steamers especially devoted to this trade, usually run from $1.25 to $1.75 per ton. This enabled importers to place gypsum in New York even under the old tariff at a cost of about $3 to $3.50 per ton. The gypsum must be shipped in lump form, otherwise the mining companies could produce it at a much lower cost. In shipping, if there is a large percentage of fines, it becomes massed in the ship's hold, and in some cases damage to the whole cargo ensues.

The Operating Companies in Cape Breton

Gypsum occurs at many points along the seaboard of Cape Breton island. In traveling along the coast one of the most marked features to be noted is the numerous white "plaster" cliffs which occur in a great many of the harbors and at many points along the shores of the Bras d'Or lakes.

At present there are only two companies engaged in quarrying gypsum on Cape Breton, namely, the Victoria Gypsum Mining and Manufacturing Company, operating at Saint Anns, Victoria county, and the Great Northern Gypsum Company, which commenced to mine during 1908 and is already manufacturing and shipping selinite plaster from near Eastern Harbor, Inverness county.

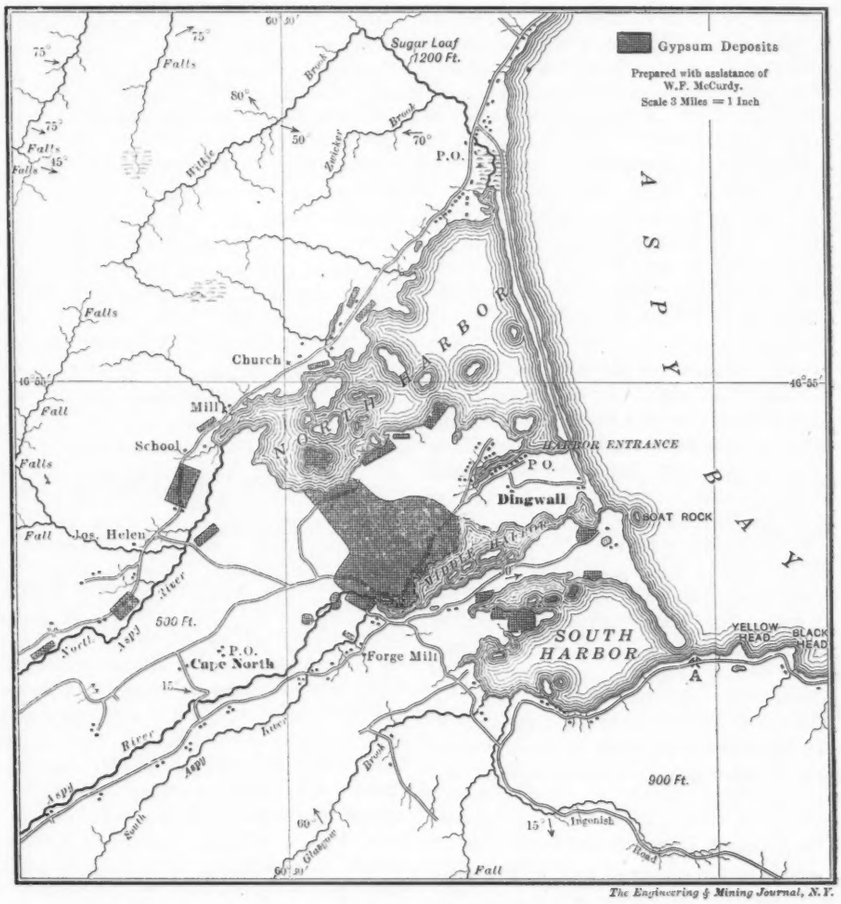
The Victoria company ships its gypsum to the Keystone Gypsum Company, of Philadelphia. The maximum output of this company is about 50,000 tons per year, the present production being about one schoonerload of 1700 tons per fortnight. Before the financial depression last year, the Victoria company had three schooners chartered, and when the market became depressed great difficulty was found in rechartering them for other uses. Formerly this company operated at Port Bevis on the Bras d'Or lake. Its present quarries are about three or four miles from the coast, and are connected with its shipping piers by steam railroads. The shipping facilities at St. Anns are modern.

The Alberta Gypsum Company, which operates at Hillsborough, in Albert county, New Brunswick, on the Bay of Fundy, has opened quarries at McKinnons Harbor on the Bras d'Or lake in Victoria county, but as yet has not begun shipping from this point. Other important deposits of gypsum are known to occur at Isle Madame, Richmond county, at Little Narrows near McKinnons Harbor, at Port Hastings, Inverness county (controlled by William Ross), and at Dingwall on Aspy bay, also Victoria county (controlled by W. F. McCurdy). These deposits are all of known commercial value, and occur at or near the seacoast.

The Aspy Bay and Ingonish Deposits

Large undeveloped deposits of gypsum are found at Ingonish and Dingwall, both on the east coast of Cape Breton island. Ingonish is about 30 miles north of Sydney, and Dingwall twice that distance.

The deposit at Dingwall on Apsy bay, a map of which accompanies this article, is of great size and rather typical of the deposits of Cape Breton island. The gypsum is exposed along the shore of the harbors, along the course of North Aspy river, and even in cuts along the roads, in great cliffs rising in places to a hight of over 50 ft. In all, this deposit covers approximately 5 square miles of territory. Probably not more than one-third of this will produce good marketable gypsum, as there is a great quantity of anhydrite, no commercial use of which has as yet been found.—This anhydrite, $CaSO_4$, has a hardness of from 3 to 3½, and contains 41.2 per cent. CaO, and 58.8 per cent. SO_3. It is granular, marble-like or fibrous, and has cleavages in three directions at right angles. The



SHADED AREA SHOWS APPROXIMATE EXTENT OF THE DINGWALL OR ASPY BAY GYPSUM DEPOSIT

gypsum has a hardness of only from 1½ to 2, and contains 32.5 per cent. CaO, 20.9 per cent. H_2O, and 46.6 per cent. SO_3. Selenite, as mined at Chetticamp, or Eastern Harbor, is a colorless, transparent variety of gypsum occurring in cleavable plates or crystals.—The deposit occupies an area of low-lying rolling country, and is for the most part covered with a rather poor growth of spruce and fir trees, although in some places where the land has been cleared it supports a fair growth of grass.

The harbor at Dingwall is exceptionally well protected and commodious, but is not accessible to boats of any size at present; therefore, this deposit can only be developed after the government has opened up the harbor. The best quality of plaster occurs between Middle and North harbors, at some distance from the water's edge, so that short railroads will have to be used to transport the material to shipping piers. At the point marked *A* on the map, on the north shore and near the entrance of South harbor, there is an interesting occurrence of lead ore.

At Ingonish, gypsum cliffs extend for almost half a mile along the coast of South harbor, and most of the way, across a neck of land about half a mile wide, to North harbor. This deposit is not so large as the one at Dingwall, but is much more accessible, as the harbor at Ingonish is now open to schooners of light drafts. The gypsum at Ingonish is for the most part of good quality, little anhydrite occurring.

THE GYPSUM INDUSTRY IN NOVA SCOTIA

At present the greater part of the gypsum shipped from Nova Scotia is mined near Windsor by the Wentworth Gypsum Company. This company, operated by J. B. King, of New York, produces about 200,000 tons per year. The Newport Plaster Mining and Manufacturing Company, operating at Avondale, near Windsor, also in Hant's county, has mined several hundred thousand tons of gypsum, but as yet is not manufacturing selenite plaster. The J. B. King company controls the largest gypsum operations in this section of Canada. It operates mines at Windsor and Avondale, Nova Scotia, and Hillsborough, New Brunswick.

The gypsum industry is rapidly expanding in this portion of Canada, and there is no doubt but that, as the larger deposits in southern Nova Scotia and New Brunswick become depleted, more attention will be directed to the available supplies on Cape Breton island. These have been shown to be of superior quality and to possess the same shipping advantages as those to the south. At St. George's bay, Newfoundland, there is also said to be a deposit of good quality, but this is quite inaccessible, so will probably not enter into the development of the industry for some time.

Pyrite Mining in New Hampshire

BY ALBERT H. FAY

In connection with the article in the JOURNAL of Sept. 4, 1909, on the pyrite deposit of the Milan Mining and Milling Company at West Milan, N. H., the accompanying table gives some data, not then at hand, regarding the analyses of the various products obtained in the sorting and dressing of the ore.

ANALYSES OF ORE DRESSING PRODUCTS AT THE MILAN MINING AND MILLING COMPANY.

Date.	Lump Ore.			Mill Feed.			Concentrate.			Middlings.			Tailings.]		
	S. %	Cu. %	SiO_2. %	S. %	Cu. %	SiO_2. %	S. %	Cu. %	SiO_2. %	S. %	Cu. %	SiO_2. %	S. %	Cu. %	SiO_2. %
July 1...	43.61	2.59	12.07	22.69	1.30	....	44.57	1.70	9.25	21.14	1.53	....	7.37	0.58	....
July 2...	39.60	1.83	14.45	18.71	0.87	....	41.47	1.45	15.15	17.70	1.01	....	7.44	0.51	....
July 3...	39.47	2.94	14.55	20.63	1.57	....	43.58	1.68	11.05	21.14	1.45	....	7.42	0.57	....
July 6...	39.47	2.94	14.55	19.27	1.44	....	44.96	1.37	10.28	20.96	1.45	....	9.75	0.66	....
July 7...	39.48	2.64	12.84	21.02	1.46	....	44.67	1.55	12.10	21.98	1.35	....	9.16	0.66	....
July 8...	41.57	1.92	11.90	24.97	1.38	....	42.85	1.16	11.50	.....	....	....	8.30	0.74	....
July 9...	41.25	2.70	9.92	24.33	1.09	....	45.82	1.26	8.07	.....	....	....	12.00	0.82	....

Dredging in California

SPECIAL CORRESPONDENCE

A great deal of prospecting is quietly going on in different portions of California to find ground suitable for dredging operations. The large dredging fields, such as those at Oroville, Folsom and Marysville, are pretty well taken up, all these being at the lower ends of rivers which have cut through gravel deposits above. But there are many isolated localities where there is room for one or more dredges to make money, and these are all being investigated. Indeed, very many places have been investigated by experts and "turned down" for one reason or another. In other places men with little or no experience in dredging operations have induced others to join them and build dredges to work on ground which the regular dredge men would not touch. In most such instances "freak" types of machines have been built, few of which have "made good." Dredge mining, like mining black sands on ocean beaches, is very attractive to numbers of people who have had little to do with mining gravels or sands for gold, and it seems easy for a certain class of men to get financial aid to start operations on such schemes.

Near La Grange, Stanislaus county, where a company is already successfully carrying on dredging operations, borings are being made to test adjacent lands. The La Grange Dredging and Power Company will install another dredge if the borings prove satisfactory. The Oro Light, Water and Power Company, of Oroville, Butte county, has lately bonded 1000 acres of land along the Merced river below Merced falls, in Merced county, and is prospecting it with drills to test values. One dredge is already at work near Snelling in that county.

Near Smartsville, in Yuba county, where extensive hydraulic mining was carried on for many years before the laws stopped that class of gold mining in the locality, drills are about to be placed on the river claim of the Marysville Quartz Tunnel and Mining Company by people who hold a bond on the ground. That section of the Yuba river forms a sort of basin or dumping ground for the tailings of numerous old gravel mines which were worked years ago, and it is expected that much gold then lost may be recovered by the dredging system. It has already been mentioned in these columns that Boston men have options on dredging lands 10 miles from Chico, Butte county, where a dredge is already working, and that dredges are proposed on the lower Klamath river.

In this connection it may be stated that Yuba county is again attracting more or less attention aside from its successful dredging enterprises. Many persons believe that the Marysville field will yet eclipse that at Oroville in productiveness by dredging, as the ground worked is much deeper and easier to handle, and there is a larger area also. Some quartz and river-bed mining is now projected at old places where mines have been long idle. Below Bridgeport, some 35 miles from Marysville, much exploration work is being done in the river, some of it with the aid of divers. A ditch has been built to bring in water and a power plant has been put up. It seems to be the intention of those engaged in this work to get at the bed of the river by diverting the waters of the Yuba. A strong diverting dam is to be put in. In the same county work is commencing at the very old and historic camp of Timbuctoo, not far from Smartsville, where very extensive hydraulic operations were at one time carried on. This time quartz mines are to be opened. Both the Marc Antony and Bullard ledges, long known, are about to be reopened.

New Publications

MINES OF THE TRANSVAAL. By R. R. Mabson. Pp. 683, illustrated. 5¼x7¾ in.; cloth, 16s. London, E. C., 1909-10: *The Statist.*

MANUEL DU MINEUR: RECHERCHES DES MINES ET LEUR EXPLOITATION. Fourth Edition. Pp. 579, illustrated. 4½x7¼ in.; cloth. Paris, 1909: Ch. Béranger.

A BIOLOGICAL SURVEY OF WALNUT LAKE, MICHIGAN. By Thomas L. Hankinson. Pp. 288, 6x9 in.; paper. Lansing, Mich.: Office of the State Geologist.

ANNUARIO DELLA INDUSTRIA MINERARIA, METALLURGICA E CHIMICA ITALIANA. Anno II, 1909. Pp. 580; 4½x6½ in.; cloth, lire 10. Torino, 1909: *Rassegna Mineraria.*

DIE SICHERHEITSVORSCHRIFTEN FÜR DIE BERGWERKE IN DEUTSCHLAND. By Bergassessor Einecker. Pp. 784. 6¼x9 in.; stoff. Essen-Ruhr, 1909: Verlagehandlung G. D. Baedeker.

PRACTICAL ARMATURE AND MAGNET WINDING. By Henry C. Horstmann and Victor H. Tousley. Pp. 231, illustrated, 4½x6¼ in., leather, $1.50. Chicago, Ill., 1909: Frederick J. Drake & Co.

EIGHTEENTH ANNUAL REPORT OF THE MINING DEPARTMENT OF TENNESSEE. By R. A. Shiflett, Chief Mine Inspector. Pp. 156. 6x9 in.; cloth. Nashville, Tenn., 1909: Mining Department of Tennessee.

DICTIONARY OF CHEMICAL AND METALLURGICAL MACHINERY, APPLIANCES AND MATERIAL. First Edition. Pp. 182. 4½x7½ in.; cloth, 50 cents. New York, 1909: *Electrochemical and Metallurgical Industry.*

CONTRIBUTIONS TO ECONOMIC GEOLOGY, 1907; Part II—Coal and Lignite. By Marius R. Campbell, Geologist in Charge. U. S. Geol. Surv., Bulletin 341. Pp. 444, illustrated. 6x9 in.; paper. Washington, D. C., 1909; Government Printing Office.

MINERAL RESOURCES OF ALASKA: REPORT ON PROGRESS OF INVESTIGATIONS IN 1909. By Alfred H. Brooks and others. U. S. Geological Survey Bulletin 379. Pp. 418, illustrated. 6x9¼ in.; paper. Washington, D. C., 1909: Government Printing Office.

SYSTEMATIC TREATMENT OF METALLIFEROUS WASTE. By L. Parry. Pp. 121, illustrated. 5½x9 in.; cloth, 5s. London, 1909: *The Mining Journal.*

Contents: Sources of supply—kinds of waste. General chemical and metallurgical principles. Partial or semi-refining. The smelting of lead ashes and the cleaning of tin slags. The smelting of tin ashes and solder ashes. The smelting of antimonial material. The separation of copper from tin, lead and antimony. Copper work. Miscellaneous. Metal working and refining.

GOLD: ITS GEOLOGICAL OCCURRENCE AND GEOGRAPHICAL DISTRIBUTION. By J. Malcolm MacLaren. Pp. 687, illustrated. 6x10 in.; cloth, $10. London, 1908: *The Mining Journal.*

Contents: Physical and chemical characters of gold. Compounds of gold. Classification of auriferous deposits. Source and transport of gold. Deposition and concentration of gold. The geographical distribution of gold—Europe; Asia; East Indian Archipelago and Polynesia; Australasia; Africa; North America; Central America and West Indies; South America.

ELECTROMAGNETIC ORE SEPARATION. By C. Godfrey Gunther. Pp. 193, illustrated. 6½x9¼ in., cloth, $3. New York, 1909: Hill Publishing Company.

Contents: Magnetism applied to ore dressing. Principles of magnetic separation and preparation of the ore for treatment. Separators for strongly magnetic minerals. Separators for feebly magnetic minerals. The concentration of magnetic ores. The separation of pyrite and blende. The separation of siderite from blende. Separation of miscellaneous ores and minerals.

This is the first book to appear in English about a very important subject. In the practical work of its field the author has had a good deal of experience, and in the preparation of his book he traveled extensively, visiting many plants where magnetic separation is practiced and carefully studying their operation. The result of his work has been a satisfactory treatise which will prove distinctly useful to many who are engaged in this branch of ore dressing.

COAL. By James Tonge. Pp. 275, illustrated. 5½x8½ in.; cloth, $2. New York, 1909: D. Van Nostrand Company.

Contents: History. Occurrence. Mode of formation of coal seams. Fossils of the coal measures. Botany of the coal-measure plants. Coalfields of the British Isles. Foreign coalfields. The classification of coals. The valuation of coal. Foreign coals and their values. Uses of coal. The production of heat from coal. Waste of coal. The preparation of coal for the market. Coaling stations of the world.

The book is intended for the general public more than for mining students. Detailed descriptions of mining methods have been purposely omitted. The character of the present work cannot be better described than by repeating the author's own words: "This book, though dealing only with the first and last of the aspects of the subject thus suggested, should be interesting and instructive not only to students of various sciences, but to the whole of those people, who, though proud of the high commercial position of England, are unaware as to how greatly this is due to our coal supplies."

THE DRESSING OF MINERALS. By Henry Louis. Pp. 544, illustrated. 7¼x10 in.; cloth, $8.50. New York: Longmans, Green and Company.

Contents: General considerations. Volumetric sizing. Sorting and washing. Comminution. Separation by specific gravity. Appliances depending essentially on vertical fall. Jigs. Horizontal current separators. Shaking tables. Pneumatic separation. Magnetic separation. Electrostatic separation. Separation by surface tension. Accessory appliances. General construction of dressing works.

This elaborate work on ore dressing is well uptodate, but in its analytical and critical treatment of the subject it does not seem to us to be quite on the same plane as some other technical contributions that have been made by its distinguished author. It seems to us, moreover, that in undertaking to fill what seems to the author to be a very definite gap in technical literature, he should have manifested a fuller recognition of the classic work of Professor Richards on the same subject. Professor Louis' book is a good treatise on the dressing of minerals, which many will be glad to have in their library, but it distinctly falls short of being a master piece in its field.

MOODY'S MANUAL OF RAILROAD AND CORPORATION STATISTICS, 1909. Tenth annual number. Prepared for the Moody Manual Company. Pp. 3198. 6½x9 in.; with maps. New York: The Moody Manual Company. Price, $12.

"Moody's Manual" is now so well established as a standard and reliable reference book, that any extended comment upon it is superfluous. It contains a mass of information, much of which is not to be found elsewhere, and which is of the highest value to all investors. Two of the features of the new edition are: An increase in the size of over 300 pages; a series of signed analytical criticisms on the values of the securities of the 100 most important railroad systems of this country by Roger W. Babson, statistician. This series enables subscribers to make comparison of real value between the securities of various railroad systems located in the same or different parts of the United States, and operating under similar or dissimilar conditions. The "Monthly Digest of Corporation News," an auxiliary publication, mailed regularly to subscribers of record gratis, includes a digest of all the news affecting corporate securities published in about 30 of the leading technical and financial publications, and tends to keep the information contained in the "Manual" strictly uptodate.

Details of Practical Mining

Notes of Interest to the Operators of Small Mines as Well as of Large Mines. The Things That Have to Be Done in Everyday Mining

REPORTS FROM EXPERIENCE

Readers of the JOURNAL are invited to contribute to this department. Articles should be brief, thoroughly practical, and preferably illustrated by drawings or sketches. Our draftsmen will prepare properly any kind of a pencil sketch that is intelligible. Something that is an old story in one district may be quite unknown in another. Articles accepted and published are suitably paid for.

Draining an Ore Chute

BY ARTHUR O. CHRISTENSEN*

At the Enterprise mine, Gunnison county, Colorado, a raise is being driven from No. 3 to No. 2 tunnel, 800 ft. above. The raise is a three-compartment incline following the vein. The manway is in the middle with skipway and chute on either side. The whole is cribbed with 8-in. timber. At every 100 ft. a level is driven on the vein in each direction. As the work progressed more or less water was encountered on the levels. This flowed to the stations, and as no provision had been made for carrying off the water, it found its way into the chute. The quantity of water was not large, but was enough to keep the dirt in the chute at just the proper consistency to stick there, the dirt being largely of a clayey character.

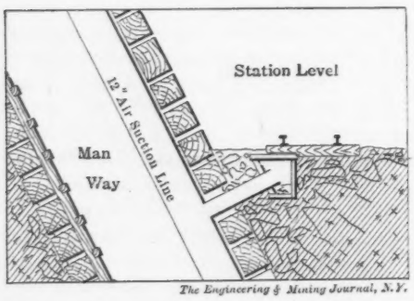


FIG. 1. DRAINAGE SCHEME FROM STATION TO SUCTION PIPE

The objection offered to making any provision for carrying off the water from the levels was that there was no room in the raise to put any conduit for it. The ladder and suction pipe filled all the space which could be spared in the manway.

At intervals of about a foot holes were bored from the manway into the chute. By the use of drills and a bent rod it was possible, with sufficient labor, whenever the chute became "hung up," which was the greater part of the time, to get it down by working through these holes. This was expensive and laborious.

At each level a length of the suction pipe was removed and a T inserted, having a 5-in. side opening. A section of 5-in. pipe was carried through the back of the raise into the station, entering it a little below the bottom. This was connected to a trough, as shown in Fig. 1. The water from the levels is run into the trough and carried by it into the suction line, through which it falls into a barrel arranged at the bottom of the raise.

By having the water fall through the airway the flow of air has been noticeably increased, and the water, instead of being trammed out with the dirt, now helps to run the compressor which supplies power for the mine.

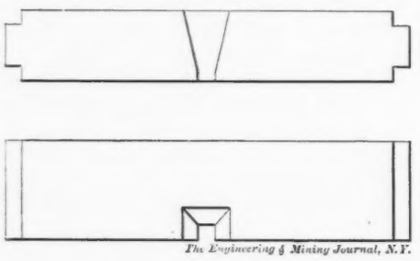


FIG. 2. METHOD OF CUTTING TIMBERS

Comparatively little difficulty is now experienced by the dirt being hung up, as the only water entering the chute is what runs in from the breast of the raise. What hang-ups do occur are readily taken care of by providing the following arrangement in the partition between the manway and the chute.

Slits 2x4 in. are cut between alternate timbers. Over the slit is nailed a piece of inch board about 5x8 in., by driving one nail at the top so the door thus formed can be swung up when it is desired to look in or to poke hung-up dirt. These doors keep small rocks and dirt from flying into the manway. The timbers now being framed are made with a groove across the middle of one edge 2x2 in. on the manway side and 6x4 on the chute side, as shown in Fig. 2.

When these partition pieces are put in they form a slit 2x4 in. on the manway side and 6x8 in. on the chute side, the slits being between every other partition piece. By having openings this size and shape a hang-up is easily pried down by working from the manway.

The chute in question is 2 ft. 8 in. x 3 ft. 8 in., cribbed solidly, but not lined. The dip of the raise varies between 60 and 70 degrees. This chute seems to be too small, for even dry dirt, after piling up in it, has to be barred down occasionally.

A chute of this dip should be lined on the bottom to prevent wear and hanging up of the dirt. Planks 2 in. or 4 in. thick, laid longitudinally, or still better, sheet iron, make good lining when well supported from underneath.

Notes on Placing and Cutting Stulls

The hitch bottom should be level and not less than 2 in. in depth, and the back edge should be at right angles to the line of the stull or as nearly so as possible. For a heading, it is sufficient to merely smooth off the face of the rock so as to enable a good fit to be secured, no bottom or sides being necessary. A vertical bevel of from 10 to 20 deg. will hold the stull firmly in place.

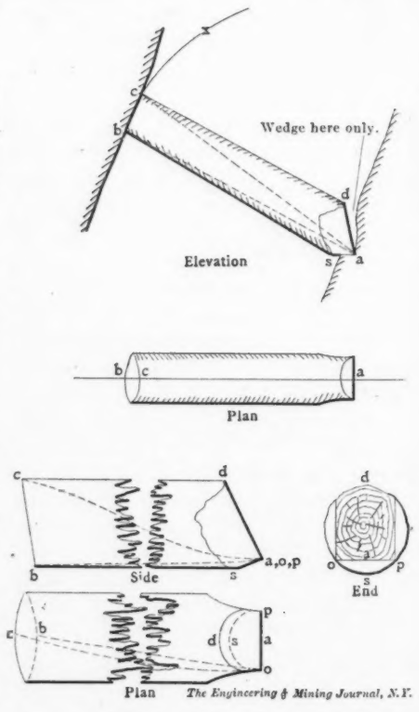


FIG. 1. METHOD OF MEASURING THE STULL

*Mining engineer, Dorchester, Colo.

To measure and cut a stull, it is well to have a slidestaff and try square, but a good fit can be made with a tape alone. Referring to Fig. 1, which contains a general sketch showing measurements to be taken and also detail for cutting the timber, the tape is held at *a*, the center of hitch on bottom, and *a-b* is measured. Point *c* is next established vertically above *b* and at a distance from it equal to the thickness of the proposed timber, and *a-c* is measured. These are all the measurements required if the hitch and heading are square. The wall above *c* must be cleared of projections that would interfere with dropping the stull into place along the arc *c-x*. The bevel of the butt of the stull (the angle *b-a-d*) may be estimated by the eye. The butt of the stull is sawed first along the line

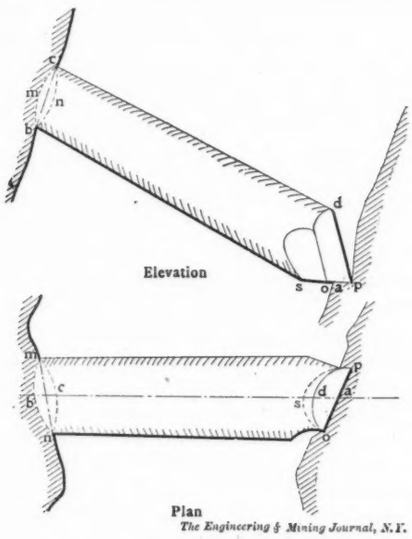


FIG. 2. THE STULL IN PLACE

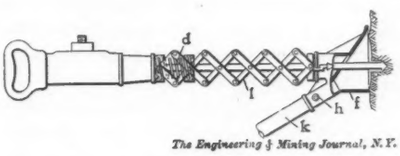
d-a making the plane *d-p-a-o* and the long corner is lopped off with an axe making the plane *s-a-o-p*, and the edge *o-p* square with the line of the timber. Then the sides are trimmed as shown making *o-p* equal to the width of the hitch. With the tape held at *o* or *p*, using the measurements *a-b* and *a-c*, the points *b* and *c* are marked on bottom and top of the timber allowing slightly for the bend in the tape caused by the partial wrapping around the stull.

It is frequently necessary to set a stull where neither hitch nor heading can be made square with the line of the timber. On the heading a circle is marked in some manner to represent approximately the outline of the stull. Referring to Fig. 2, point *a* is the back center of hitch bottom, and *o* and *p* the corners; *b*, *c*, *n*, and *m* are respectively the bottom, top, and sides of the circle marked on the heading; *a-b*, *b-o*, *b-p*, *n-o*, and *m-p* are measured. The face *s-o-p-a*, is first made by a cut with the axe and a mark made on this to represent to point *a*. *A-b* is then measured and *b* marked; *o* and *p* are located equidistant from *a* by the measurements *b-p* and *b-o* from point *b*, care being taken that *o-p* is equal to width of hitch. The face *d-o-p* is sawed and the sides trimmed; *o-n* and *p-m* are laid off and the head is sawed through the points *b*, *m*, and *n*. Additional measurements to *c* may be made as a check. A stull of this kind should be braced laterally by a collar brace to the next timber.

Wedging must be done at the butt. The head should fit snugly against the rock at all points but especially at the bottom. Wedges driven at the head are a sign of poor work.

Drill Dust Collector

A German contrivance for collecting the dust produced by an air-hammer drill is illustrated in the accompanying figure. (*Zeits. für B., H. und S.- wesen*, 1909, No. 1). It is giving satisfactory service



DUST COLLECTOR RIGGED ON DRILL

in the Shamrock I-II mine in Prussia. The dust is caught in the funnel *f* and passes down the pipe *k* into a sack. The funnel is pushed against the rock face by the spring *d*, acting through the system of levers *l*.

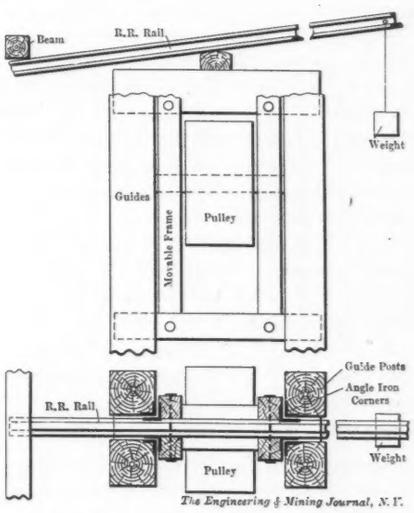
Crane for Use in Machine Shop

In a shop where heavy work has to be done the use of a traveling crane is absolutely necessary if it be desired to do work easily and rapidly. A crane that is being used extensively in the Mesabi range, Minnesota, is one that travels in a circle. The traveling arm is an 8- or 10-in. I-beam, or any size that is sufficiently strong to do the work required. One end is pivoted in the center of the shop, while to the outer end is attached a car wheel of suitable size. Railroad rail is bent in the form of a circle and suspended from the beams above. The track forms a complete circle, and the traveling arm can thus be placed over any part of the floor. A tackle block, mounted upon a traveler, is suspended from the I-beam. A crane of this type is not so heavy as the ones with the long span which are operated upon tracks attached to the wall posts. Its cost of installation is less, and yet it will do effective work, although operated by hand power.

Self Adjusting Bucket Elevator Pulley

The accompanying illustration shows a device whereby the tension on elevator belts may be kept constant. A movable frame is made for the pulley in the usual way and is reinforced by angle iron, as shown. On the top of the frame is placed a piece of wood, or iron, to give a bearing for a railroad rail, one end of which is fixed permanently to a beam or post of the building.

This rail may be any length, 10 to 12 ft., and sufficient weight is added to the free end to give the belt the desired tension. This has the advantage over the type that is adjusted by screws, inasmuch as the pulley will give in case anything is



SELF ADJUSTING PULLEY FOR BUCKET ELEVATOR

run in between the pulley and belt; also should the belt shrink, the tension will remain the same.

Scheme for Loosening a Stuck Drill Steel

In drilling deep holes by hand with 15- or 20-ft. steel, the bar often sticks; or, in some cases, a drill is actually driven in soft ground as one would drive a stake, and then it becomes necessary to resort to some means to remove it. This may be done easily by taking a piece of steel 1¼ or 1½ in. thick, 6 in. square, with a hole in the center about twice the size of the drill. This is placed over the head of the drill and two steel wedges driven in, to fasten the piece of steel on the drill. This gives a good shoulder against which to hammer. A few blows on this will soon loosen the bar. It is much more effective than a chain and lever, or pulley block.

Personal

Mining and metallurgical engineers are invited to keep THE ENGINEERING AND MINING JOURNAL informed of their movements and appointments.

Dr. James Douglas arrived home on the "Mauretania," Sept. 9.

H. H. Gregg, of Joplin, Mo., has been chosen permanent chairman of the zinc ore tariff club.

Theodore Gross, of the London Venture Corporation, has returned to New York from his trip to London.

Arthur Lakes, of Denver, has been making examination of mining property near Hahn's peak, Colorado.

Max Boehmer, of Leadville, has been appointed consulting engineer of the Druid Mining Company, in Gilpin county, Colorado.

H. G. C. Thofern, manager of the French syndicate operating at Nioca, Chihuahua, Mex., is in New York purchasing machinery.

Walter Harvey Weed, of New York and F. H. Probert, of Los Angeles, are making examinations in the Guanajuato district of Mexico.

C. L. Constant, Jr., of the C. L. Constant Company, consulting engineers, New York, has left for points in Ontario on professional business.

F. T. Havard, of Helena, Mont., and well known as a metallurgical engineer, has accepted the chair of metallurgy at the University of Wisconsin, Madison, Wis.

Newman Erb, formerly president of the Wisconsin Central Railway Company, has resigned as a director and as chairman of the board of the Davis-Daly Copper Company.

Frank L. Sizer, of Montana, has been appointed superintendent of the Balaklala Consolidated Copper Company in Shasta county, Cal., succeeding R. N. Bishop, who has resigned.

R. N. Bishop, mine manager of the Balaklala Consolidated Copper Company, has resigned to devote his time to personal interests. He will have an office at 1121 First National Bank building, San Francisco.

Dr. Benzo Katsuro, professor of metallurgy in the Tokio Imperial University, has recently been visiting mines of Bingham and other Utah camps to gather data concerning our methods of mining and treating ores.

Henry Fisher has been appointed superintendent of the Calumet & Hecla stamp mills at Lake Linden, Mich. Mr. Fisher, who has been acting superintendent since the death of the late H. W. Cake, has been an employee of the company for the past 40 years, starting in the capacity of a machinist.

Thos. H. Soddy has been appointed superintendent of motive power for the Calumet & Hecla mines, succeeding Jas. D. Ramsay, who retired about one year ago. Mr. Soddy is an old employee of the company, starting when the mine first opened about 43 years ago, and has worked in various capacities up to the present responsible position.

Obituary

William C. Davis, vice-president and general manager of the F. M. Davis Iron Works Company, Denver, Colo., died at Denver, August 18, aged 45 years. He was a graduate in mechanical engineering of the Massachusetts Institute of Technology and ever since his graduation had been connected with the Davis company, of which his father is the head. He was the inventor and designer of much of the mining and smelting machinery that is built by this company and possessed a high order of ability in his specialty. He was widely known in the mining industry of Colorado and adjacent States and had many warm friends, who appreciated his engineering ability and his genial personality.

C. G. Warnford-Lock died at Bandarawella, Ceylon, July 30. He was the son of a mining engineer, and was born in Hampshire on Sept. 9, 1853. Mr. Warnford-Lock was educated at Cranleigh, and his first professional engagement was in the sulphur mines of Iceland. He was afterward engaged in alluvial mining in Hungary, and later on held responsible positions as mine manager in the Black Hills of South Dakota and in New South Wales. It was in the latter country, in 1896, that he took charge of the Wentworth Gold Fields Proprietary Company's mines. While he was controlling affairs there a prolonged strike took place, and it was owing to his energy and determination that he was able to run the mines during the period of disturbance, and bring the strike to a satisfactory issue. Mr. Warnford-Lock also managed mines for the Bulawayo Exploration Company, at Gwelo, Rhodesia, and for the Raub Gold Mining Syndicate in the Malay peninsula. For some time he resided in Sydney, where he practised as a consulting mining engineer.

He was the author of several well known works on mining and cognate subjects, of which the chief are: "Practical Gold Mining" (1889); "Mining and Ore Dressing Machinery" (1890); "Economic Mining" (1895); "Principles and Practice of Gold Milling" (1901); and "The Miner's Pocket Book," which ran into five editions, the last being published in 1907. In that year he also brought out his last work, "Mining in Malaya for Gold and Tin," the second edition of which has already been issued.

Mr. Warnford-Lock was one of the original members of the Institution of Mining and Metallurgy, and served on its council and on its various committees. He moreover contributed several papers on mining and metallurgical subjects to the transactions of the institution, and always maintained a keen interest in its affairs and well being.

He returned to Malaya in 1908, where he was engaged in inspecting and reporting on properties for various mining companies. An attack of ptomaine poisoning in the autumn of last year seriously impaired his constitution, and he was compelled to take voyages to China and Ceylon to recuperate his health. These were unfortunately unavailing.

Societies and Technical Schools

American Mining Congress—The annual meeting of this organization will be held at Goldfield, Nev., Sept. 27 to Oct. 2. An interesting program has been prepared. Special trains will be run from Los Angeles and San Francisco. Some interesting papers will be read, and the local executive committee at Goldfield has arranged bountifully for the entertainment of the visitors.

Michigan Geological Survey—This organization has published the following resolutions:

WHEREAS, Dr. Alfred C. Lane, for 20 years State geologist for Michigan, has resigned his position in this capacity, therefore be it

RESOLVED, by the State Board of Geological Survey that Dr. Lane's resignation is greatly regretted by this board. His administration has been unprecedented in length of time and unparalleled in amount of publication and marked by uninterruptedly harmonious relations with other boards and the great schools of the State. Geological work has been fairly distributed in all parts of the State and without neglecting pure science, economic results have been obtained. Among the economic results gained have been the following: Copper lodes have been located; coal production has increased from 50,000 to 1,500,000 tons; rock salt is now to be mined; soda, salt, mineral water, limestone, cement and clay industries have been fostered and valuable advice on water supply given. In view of these well known facts, be it further

RESOLVED, that the severing of Doctor Lane's official relations with this work is a distinct loss to the State, and that another State is to be congratulated on securing the services of a man who has for so long done valuable work for Michigan, and be it further

RESOLVED, that a copy of these resolutions be spread on the minutes of the Board of Geological Survey.

Special Correspondence from Mining Centers

News of the Industry Reported by Special Representatives at Butte, Denver, Salt Lake City, Goldfield, Cobalt and Toronto

REVIEWS OF IMPORTANT EVENTS

San Francisco

Sept. 8—Two important mining deals have recently been carried out in Nevada county, the principal of which is the purchase of the old Iron Mountain mine at Indian Springs from M. C. Taylor by the United States Smelting, Refining and Mining Company. At the surface the mine was worked for iron ore years ago, but as depth was attained a large body of sulphide copper ore was found. It is understood that a broad-gage railroad will be built to connect the mine with the main line of the Southern Pacific, and that the property will be worked on a large scale. The breaking of ground for the new central shaft of the Brunswick Gold Mining Company, Grass Valley district, is another matter of importance. Manager C. H. Mallon says this new shaft will be sunk to 2500 ft. without a stop. This shaft should intersect the vein at a depth of 1500 ft. The new shaft will have three compartments, and will be equipped with electrical machinery. It is 2600 ft. east from the old shaft on the property. When the shaft has reached 1200 ft. a pump will be installed to unwater the old mine, now filled. The undertaking is the most important which has taken place in the district in some years.

In Sierra county at Sailor's Ravine, near Forest, a remarkably rich strike has been made in the Lucky Frye mine after a long period of prospecting and development. This is one of the newer properties of the county, and is owned by Jason Frye and J. E. Winrow.

The Gold Canyon mine on the Middle Yuba river, below the Plumbaho power house, is also the scene of a new strike. The rich ore was found while extending the drain tunnel, and was only a few feet from where the late F. B. Hill quit work when the mine was known as the Two Counties. Years ago the mine yielded handsomely while being worked by the late D. R. McKillican, of North Bloomfield.

In Amador county sinking has been discontinued for the present at the Kennedy mine at Jackson after the shaft had been sunk 3405 ft. vertically, including the sump. A new level is being opened at the 3300 level of the mine. This property is yielding largely and paying regular dividends. At the 3150-ft. level of the Argonaut, the adjoining mine to the Kennedy, crosscutting has been commenced. Resumption of dividends will soon be in order at this mine. In the same county the old Keystone is having many improvements made of an important character. The old 40-stamp batteries are being overhauled and repairs and excavations have been made for the foundation for a new 80-stamp mill. Finally the mine will have 140 stamps altogether, so that large quantities of low-grade ore may be milled at a profit. Among other improvements the Patton shaft will be sunk 200 ft. deeper.

In El Dorado county while plowing in the main street at Georgetown for the purpose of leveling it, a quartz ledge showing free gold was discovered by the workmen. Near Nashville at the Union mine a new shaft is being sunk to open new ground at a depth of 600 to 800 ft. The old works will be unwatered and a shaft sunk from the 1000 to the 1500 level. The Monarch Consolidated, also at Nashville, is sinking from the 800 to the 1100-ft. level, with the hope of finding the pay shoot which was worked in the higher levels. Considerable other work is being done in this belt of free-milling gold ores.

The fact that the Natomas Consolidated Company, of California, owning dredges and dredge ground at Folsom and elsewhere, has filed articles of incorporation in El Dorado county, is taken as evidence that the company is about to begin dredging operations in that county.

Denver

Sept. 10—In the Cripple Creek gold district, the August production of the Western Investment Company's lease on the Raven hill property of the Mary McKinney company is given at 776 tons, yielding from $25 to $30 per ton. The Gold Hill end of the Mary McKinney company's holdings is also shipping. The Portland company reports the discovery of a new orebody 4 to 6 ft. wide, carrying 3 oz. gold per ton, as broken. The vein was exposed years ago by a cut made for the Circle railroad, and not then considered of any value, but the repeated applications for leases on this ground led the company to do some exploitation work, with the foregoing result. The company is now sinking a two-compartment shaft on the vein in the vicinity of the shoot, and has erected ore bins.

The deep drainage tunnel now measures 10,465 ft. from portal to breast, and it is said to be a splendid piece of work, reflecting credit on the contractor, A. E. Carlton. The importance of this enterprise, which, when completed, will add at least 10 years to the life of that wonderful camp, can hardly be estimated. The Rigi mine, in the gap between Battle and Bull hills, is to be equipped with machinery and its production increased. It was always supposed to be an extension of the Ocean Wave vein of the Modoc company, which is credited with a production of approximately half a million dollars. In the early day the Rigi was worked under lease by Charles J. Moore, then consulting engineer for the Portland company. The August production of the El Paso company is given at 1800 tons, some of this being dump ore, which is being milled on the ground. The mine ore averages $30, and that of the dump $6 per ton. The ore production of the whole camp is said to be unusually heavy so far this month.

The advance in the spelter market is causing renewed activity in the zinc-producing mines of the State, especially those of Leadville. At Central City, the Fifty Gold Mines Corporation has sent to the bank another $5000 gold brick, the result of a 10-day run on ore from the Gregory-Bobtail workings at depth of from 1100 to 1400 feet.

The old Batchelor mine, which some 20 years ago was the chief silver producer in the sedimentaries north of Ouray, and yielded $2,000,000 at that time, is now under lease again, and to the fore with a reported strike of 18 in. of 1000-oz. silver ore. The character of the ore in this mine is argentiferous galena, associated with gray copper. The leasers are two of the original owners, George Hurlburt and Charles Armstrong. The tonnage for Ouray for August is given at 1175 tons, of a gross value of $60,000, and this is exclusive of the gold bullion from the Camp Bird, Revenue and Atlas mines.

The San Juan mines had a hard time during the last nine months of winter snows, and are now having almost as hard a time with its fluid equivalent. At Durango, on Sept. 6, the Animas river rose high enough to close down the furnaces and roasters of the smeltery there, and it will take 10 days to repair the railroad and bridges between that town and Silverton. At Telluride, the dam at Trout lake, which supplies the Telluride Power Company, broke, and sent the entire volume of the lake down the South fork of the San Miguel river, and damaged towns, mining property, etc., to an extent of approximately $300,000. The electric power at Telluride was shut off, and the mining industry placed at a standstill. This also closed temporarily the Camp Bird mine, across the divide. The Buckley mill was carried away, and the town of Placerville

was wiped out, and most of the railroad track between that place and Telluride was washed away.

Butte

Sept. 9—The United States assay office at Helena reports that $240,982 worth of bullion was received during August. This is an unusually large amount for Montana. Chouteau county was first in production with $99,238 and Fergus county second with $61,524.

The affairs of the Pittsburg & Montana Copper company are in a somewhat involved state. Last spring, it was given out that the East Butte company was to acquire the entire interests of the former company and a stockholders' meeting of the East Butte company was held to vote upon the question. Then in July the bondholders of the Pittsburg & Montana company started to foreclose the mortgage and Oscar Rohn was appointed receiver. The latest move in the company's affairs is the filing with the Montana secretary of state of articles of incorporation of the Pittsmont Copper company, a West Virginia corporation, capitalized at $11,000,000. It is presumed that the new company will take over the properties of the old as a part of the general scheme of reorganization.

Recent heavy rains have caused a number of washouts on the surface roads of the Amalgamated company's properties and necessitated considerable repairs. Within the last week, crosscuts have been started north and south on the 1300-ft. level of the Badger State. New ore bins are now being installed and also a new boiler house. When the latter is finished a new boiler plant will be put in. The present hoist on the property is good for 2000 ft. At the West Colusa mine a crosscut has been started on the 1800-ft. level which will meet the east drift on the 1800-ft. level of the Mountain View mine. The distance between the two points is about 1400 ft. and it is estimated that it will take two months to complete the work. At the Leonard mine, two of the air compressors were shut down for three days last week. These compressors supply air to the air-driven pump on the 1800-ft. level of the Pennsylvania, the lowest level of that mine, and as a result the water rose in the sump and flooded the 1800 station to a depth of three feet.

Goldfield

Sept. 10—The Goldfield Consolidated output for August shows the heaviest tonnage for any one month in the history of the mine. A total of 22,160 tons of ore was produced, having a gross value of $602,000. The cost of production, including mining, milling, transportation and general expense, is estimated at $155,000 leaving an estimated net profit of $447,000 The output includes about 150 tons of smelting ore from the Hampton stope, having an average value of about $600 per ton.

A number of surface improvements are being made around the Clermont shaft; a change room, 20x60 ft. in size, has been constructed, and work upon ore bins of at least 500 tons capacity will soon be started. Grading is under way for extending the Consolidated railway to the above bins. On the 600-ft. level of the Clermont shaft a crosscut is being run to cut the Red Top vein. When completed this crosscut will cut the vein about 270 ft. below the deepest level of the Red Top shaft. On the 860-ft. level a crosscut is being driven to intercept the Jumbo vein on its course downward.

The specimen ore received at the Nevada Mineral Palace is now being classified and catalogued and placed in show cases. The Wells-Fargo Express company has agreed to give free transportation of specimens for the exhibit, from all points in the State providing the consignment does not weigh over 20 pounds.

Salt Lake City

Sept. 10—With the work of remodeling the Copperton mill of the Utah Copper Company completed, the mine will begin producing more than at any previous time. Last spring the mill was treating 750 tons of ore daily at a comparatively high cost. The management closed the mill and installed the processes used at the Garfield mill and now the Copperton plant has a capacity of 1000 tons daily with the cost almost as low as at the Garfield concentrator. Formerly the net cost of producing copper, including mining, milling and smelting, was 9.192c. per pound at the Copperton mill and it is expected now that it will be about 8.98c. The steam shovels are now in a better grade of ore which will also reduce the cost of production.

The management of the Iron Blossom reports that the characteristic high-grade ore in the north shaft has returned and that conditions at the mine are encouraging. Under the main level, the orebody that was temporarily lost, continues now in full strength. The ore that is being extracted is of a high grade and the shipments are heavy.

A project of importance is under way in the Park City district. The plan includes a long tunnel from the old Comstock-California properties in Thaynes cañon through Scott hill to the Copper Apex and Iowa Copper workings. This tunnel would drain the lower levels of some promising prospects where the water has prevented further development and would provide an outlet of the ores on a lower level in the cañon, which would assure cheap transportation to Park City.

The details of the consolidation of the Bingham-Central Standard, Bingham Central, Bingham Standard, and Bingham Metals properties are practically complete and the articles of incorporation will be filed next week. Walter B. Farmer, of Boston, who is heavily interested in the enterprise and Sam H. Treloar, manager, are conducting a party of interested Boston capitalists through the properties. The new company will install electrical equipment and build its own power plant. A transportation tunnel will be driven through the mountain from the Bingham Metals grounds to the mining properties in Carr fork.

The Silver-King Coalition Company, of Park City, will on October 1, distribute $187,000 among its stockholders, the regular quarterly dividend of 15c. per share. The dividends of this mine now amount to nearly $12,000,000.

The Thor Mining Company, capitalized at $100,000, has been formed to operate in the Bonanza Flat district in Big Cottonwood. The company controls 22 claims located around the Snake Creek tunnel project, which will permit deep development work. Work will be started at once sinking a shaft and driving two tunnels to ascertain the possibilities of the proposition.

Ore shipments from Tintic during the past week amounted to 207 cars. The shipments follow: In 50-ton cars, Centennial Eureka, 40; Scranton, 4; Grand Central, 5; Victoria, 4; Sioux Consolidated, 17; May Day, 2; May Day (concentrates), 1; Eagle & Blue Bell, 3; Chief Consolidated, 2; Uncle Sam, 3; East Tintic Development, 2; Ajax, 8; Eureka Hill, 3; Yankee, 2; Bullion Beck, 3; in 20-ton cars, Iron Blossom, 27; Colorado, 29; Dragon Iron, 44; Beck Tunnel, 7 cars.

Cobalt

Sept. 12—Although no official announcement has been made at Toronto, there are indications that the petition of several of the Cobalt mines to have the heavy royalties reduced will be considered. A deputation recently called upon the officials, and received an assurance that the matter would be taken into consideration.

The work on the substations of the Mines Power Company at Cobalt and Kerr lake is making good headway. At Cobalt, the substation is being built on the Nipissing property, just back of the Cobalt lake, and the poles for the transmission line have been erected. The substation which is to serve the Kerr Lake district is being built at Brady lake. Altogether there is a total of about 1000 men at work, 700 working on the plant at Matabechewan river, and about 300 more on the transmission lines and substations.

In the drilling contest held in Cobalt on Sept. 6, the first prize was taken by the team from the Nova Scotia mine, who drilled 38½ in. In a similar contest, held on Aug. 18, this same team only drilled

25⅜ in. The difference in these records, as well as those made by the other competing teams, is largely due to the great strides made since the advent of Pickens and Page, the world's champions, who drilled here in the first contest.

It is understood that Montreal interests identified with the Crown Reserve have obtained control of the Silver Leaf, and the appointment of Colonel Carson, president of the Crown Reserve, and Mr. Cohen, manager of the same company, to the positions of president and consulting engineer, respectively, of the Silver Leaf, would seem to point to the authenticity of the report. The Silver Leaf is capitalized at $5,000,000, and it is understood that a controlling interest in the stock was held in New York, and that this has been sold at a price far enough under the market value to prove attractive to the adjoining company. Up to date the property has never done anything to justify the large capitalization, as only about $300,000 worth of ore has been produced. The greater portion of this was taken from the continuation of the Crown Reserve vein, but soon after entering the Silver Leaf property the vein pinched out.

The provincial government, after almost inexcusable negligence, has recognized the gravity of the fever situation in Cobalt. Doctor Hodgets, the medical officer for the province, has been in camp, and is taking active steps to clean up the town, and remove the accumulation of filth. Four special inspectors have been sent from Toronto to look after the work, and it is hoped that the methods now being employed will be successful.

Some good finds have been made lately in the Gowganda district, and it is expected that within the next few months the camp will make a much better showing, and will recover to some extent from the ill-advised advertising to which it has been subjected since the first rush commenced. At present the prices of supplies are very high, and as an instance it may be stated that hay is worth $160 per ton, potatoes $17 a bag and blacksmith coal costs $92.50 per ton.

Toronto

Sept. 12—Hon. Frank Cochrane, Ontario, minister of lands, forests and mines, in a speech at Haileybury on Sept. 7, announced that the provincial government would make a large increase in the appropriations for opening up and developing northern Ontario.

A similar policy with regard to Quebec was outlined by the premier, Sir Lomer Gouin, in an address at St. Johns, Que., on the 6th, when he said that they wanted a Quebec "Cobalt." If the report of mining authorities who would be sent to the Chibugamoo district to investigate its supposed mineral wealth was to the effect that it was worth the cost, the provincial government would build a railway to serve the district.

Transportation facilities to Gowganda and the neighboring camp will be greatly improved for the coming winter. The government wagon-road connecting Gowganda and Elk City with the railway at Charlton will be a first-class highway. The Bisco route by road and water connecting Gowganda with the main line of the Canadian Pacific will be an active competitor. Since last winter the extension of the Canadian Northern Railway has brought it to within 35 miles from Gowganda and a new cut will be made from the railroad to Phœnix, following from that point a natural route to the camps at Shining Tree, Elkhorn and Gowganda.

The annual report of the gas and electricity inspection branch of the Canadian inland revenue department for the fiscal year ending March 31, shows that the total amount of electricity exported was 359,283,286 kw. hours, as compared with 135,075,680 kw. hours generated for home consumption. During the year only one company, the Provincial Natural Gas and Fuel Company exported natural gas, its exports amounting to 387,019,800 cu.ft. No further licenses allowing the exportation of natural gas will be issued.

Mexico

Sept. 10—The mining companies of Mexico have endeavored to secure special rates from the railroads for the shipment of zinc ore to gulf ports for export to Europe, but so far have had no encouragement. However, it is believed that they will be able to ship profitably to the European market, notwithstanding the comparatively high rail rates which prevail on this low-grade product. Buyers at Chihuahua are offering 25.28 pesos per metric ton for 40 per cent. ore at Chihuahua on the basis of £22 per long ton of spelter in the London market. This offering is less than the average rate which prevailed for the American market, but still it permits of the profitable operation of the Mexican mines in many instances. The steamship companies have made very low rates on the shipment of zinc ore to Europe, and have promised to continue the low rates in order to permit and encourage the business.

The express business of the National Railways of Mexico, formerly controlled by the Wells-Fargo company, is now operated by a Mexican company, in which the Mexican government owns control. This company also controls the National Express Company, and the Interoceanic Express Company. The movement is along the line of the increased government interest in the transportation of the republic. The Mexican government also owns the telegraph lines, and with the successful outcome of the railroad merger practically has the control of the transportation and telegraph systems of the republic in hand.

The concession for the proposed railroad from Monclova to Chihuahua has been ratified by the new state legislature in Coahuila, and a subsidy of 5000 pesos per mile has been granted within the limits of Coahuila. It is expected that Chihuahua will grant a like subsidy and that the road will be built. The road opens up important coalfields in the northern states, and will be a means of outlet for the coal mines to the important consuming centers of the northern part of the republic. It is rumored that the F. S. Pearson syndicate, which has already large interests in Mexico and which has organized the Northwestern Railway Company to purchase the Chihuahua & Pacific, the Sierra Madre & Pacific, and the Rio Grande, Sierra Madre & Pacific, will be interested in the new road, but the situation has not progressed far enough to make this definite as yet. The concession is granted to Edward Hartman. For a time it was thought that the concession would be refused by the new government in control of Coahuila. The distance from Chihuahua to Monclava is 700 km., over a very level country.

It is reported now that the Mexican Central has restored the use of the oil-burning locomotives on the southern divisions, being able again to secure a sufficient supply from Ebano to take care of the business.

The whole Mexican mining industry is interested in the various propositions for the installation of self-contained and small-unit treatment plants at the mines and numerous inventions and suggestions are offered to the miners of the republic along these lines. The transportation conditions make it imperative that something should be done to relieve the mines from the burden of transporting low-grade or moderate-grade ore over long, extensive trails, and the inclination is to install treatment plants at the mines.

London

Sept. 4—A certain amount of interest is taken in West African mining shares but the interest appears to be mostly professional. As lately announced in the JOURNAL, a good deal of fresh capital has been found to carry on development work and those who have interests in the country appear to be taking it for granted that the success of West African mines is now beyond doubt, ignoring altogether the experience of the past when over and over again the optimists have proved false prophets. Until the results of the development work are known and until closer estimates can be made of the earning powers of the properties now being opened up the public would be well advised to leave West African shares alone.

Mining News from All Parts of the World

New Enterprises, Installations of New Machinery, Development of Mines and Transfers of Property Reported by Special Correspondents

THE CURRENT HISTORY OF MINING

General Mining News

Phelps, Dodge & Co., Inc.—The copper production of the various properties of this company during August amounted to approximately 11,000,000 lb., of which the Detroit Copper Company contributed about 2,000,000 lb. and the Copper Queen and Moctezuma properties 9,100,000. The production to date this year has been 87,934,000 lb. and with this rate maintained, the annual output of copper by this company, will approximate 130,000,000 lb. The directors will hold a meeting this week to take dividend action. Two quarterly dividends of $2.50, each, have been paid, this year.

Alaska

Nome—Oil burners are displacing coal throughout the district. It has been demonstrated that oil in many cases is cheaper than coal in its steam-producing qualities for thawing plants. The Sesnon Company, the Pioneer Mining Company and others are employing California crude petroleum this season.

Fairbanks—Rich strikes have been made in the Innoko country, southeast of Norton sound. This is the third season of prospecting in the Innoko district.

Alaska-Perseverance—During July, 14,928 tons of ore were treated, from which a total recovery of $1.73 per ton was made.

Dawson—The first quartz mill in the Klondike was started on the property of the Lone Star, on Victoria gulch. William Catto is president.

Yukon Gold—The new electrical conveyer installed at 58 Below on Bonanza creek has been started, using the power from 60 miles distant.

Arizona

Cohise County

Copper Queen—The company has started extensive exploration and development work from the 1400-ft. level of the Lowell shaft and the 1600-ft. level of the Sacremento.

Gila County

Inspiration—At a depth of 400 ft., a station is being cut at the Joe Bush shaft, and after its completion drifting is to be started in the four cardinal directions. The orebody encountered at 90 ft. has now been disclosed for a depth of 320 ft., and is estimated to average 2.5 per cent. copper. An increased flow of water was encountered near the 400 level, but it is still being handled by the gasolene hoist and buckets. Slightly higher-grade material has been passed through in the lower portion of the Joe Bush shaft, the last 35 ft. having averaged 2.9 per cent. A shaft has been started on the Scorpion claim of the recently acquired Black Copper group. Drill holes have indicated that the orebody here lies at greater depth than at the Joe Bush shaft.

Old Dominion—The August output was 3,260,000 lb., a decrease of 241,000 lb. from the August production of last year.

Cole-Goodwin—Work has been started on this property near Globe after five years of litigation. P. J. Cole is in charge.

Graham County

Arizona Copper—The company produced in August 2,600,000 lb. of copper, an increase of 200,000 lb. over the July output.

Maricopa County

Vulture—Twenty stamps are now dropping at the 80-stamp mill of this company near Wickenburg, the second 10-stamp unit having been placed in commission on Sept. 11. W. Spencer Hutchinson, engineer in charge.

Pinal County

Ray Consolidated—The company now has over $4,000,000 cash available from the sale of the recent stock issue, and preparations are being made for the construction of the reduction plants. Production is expected to commence in about 15 months. Eleven churn drills are at work exploring the orebodies and there has been disclosed approximately 50,000,000 tons, estimated to average 2.3 per cent. copper. It might be noted that this tonnage has been developed on about one-fifth of the area covered by the company's property, other portions of which are expected to disclose payable quantities of copper upon exploration.

California

Amador County

South Eureka—This company at Sutter Creek which has been renting 20 stamps from the Central Eureka, is about to add 20 stamps to its own mill.

Original Amador—At this property, Amador City, the new mill is nearly completed and the ore bins are being built.

Newton—It is reported that this copper mine, near Ione, has passed into the hands of the Peyton Chemical Company, and that the property will again be operated.

Butte County

Banner—This mine, six miles from Oroville, at one time owned by an English company, has been sold to W. E. Livesley and T. Fitzgibbons.

Calaveras County

Union Copper—This mine at Copperopolis has been sold to the Calaveras Copper Company, organized by P. Chester Thompson, of New York and Salt Lake. The property has belonged to the Ames estate, of Boston, since 1869, and has been extensively worked. It is equipped with a 300-ton smeltery and 600-ton concentrator. A hydroelectric installation will be made by the new company. Josiah H. Trerise will be manager of the company. The Ames estate retains a large interest and is represented on the board by Charles M. Hayden.

Nuner—The gravel mine at Mokelumne hill has been placed under bond to New York men and active operations have commenced. The upper channel is to be opened by a raise from the lower tunnel.

El Dorado County

Vandalia—The mine, near Shingle, has been purchased from Merrill, Reed & Seymour by the Alaufeseyite Products Company, which will open and work it extensively.

Inyo County

Maverick—At this group, formerly the Neylon, at Bishop, a new tunnel will be started 300 ft. up the hill from the main tunnel. Air compressors have been ordered by Superintendent William Eva.

Mariposa County

Daws & Thorne—The mine at Hornitos has been purchased by the Reliance Mining Company, and milling machinery has been ordered. F. M. Johnson is in charge.

Nevada County

Golden State—J. T. Hennessy, Thomas Gill and other Grass Valley men have purchased this mine. There is a five-stamp mill at the mine.

Empire Mines—The company has started its new five-throw electric plunger pump on the 2200 level, lifting the water 1100 ft. Another pump of the same description is being installed on the 3400 level to lift to the 2200 level. At the 1100, the hydraulic pump takes the water to the drain tunnel.

Eagle Bird—The 30-stamp mill, machine shop and compressor room at Maybert have been destroyed by fire.

PLACER COUNTY

Dewey—This drift mine on the Forest Hill divide has been bonded to a Denver company and a new tunnel is being run. W. R. Grant is in charge.

SAN BENITO COUNTY

New Idria—From the operation of three furnaces the quicksilver production for the year ended Dec. 31, 1908, was 9600 flasks; sales amounted to $231,389, with a net profit of $147,289. The mine still has large ore reserves.

SAN LUIS OBISPO COUNTY

Pozo Placers—The company which is to dredge the sand and gravel at this place is having machinery built in Wisconsin and several carloads will shortly arrive. An electric power plant is to be established.

SIERRA COUNTY

Eclipse—The company recently bonded the Foster & Squires claims, near Gibsonville, and will put up the 10-stamp mill already ordered.

Acme—This company at Whisky digging, two miles from Gibsonville, will shortly put up a 5-stamp mill.

SHASTA COUNTY

Tarantula—This group of claims, west of Iron mountain, now under bond to Stauffer Chemical Company interests of San Francisco, is developing favorably. The main ledge is 5 ft. wide and carries free gold. Charles Kunze, Redding, superintendent.

TRINITY COUNTY

Eastman Gulch—In this district four mines are now taking out shipping ore, the principal producer being the Knob or Gifford mine, under lease to James Wilson and Gus Ehrman. The ore will be worked at Deadwood and will be packed over the mountain.

Colorado

CLEAR CREEK AND GILPIN COUNTIES

German—Uranium ore of high grade has been found in this mine, which belongs to Bishop Matz of Denver.

Griffith Mines—Work has been commenced on the construction of the 50-ton, Malm process mill at Georgetown.

Centennial—A 50-ton stamp mill will be erected at this mine at Georgetown.

EAGLE COUNTY

Eagle Mining and Milling—The mill at Red Cliff is completed and is treating Iron Mask ore.

LAKE COUNTY—LEADVILLE

Highland Chief—This property, in Iowa gulch, a heavy producer in early days, will resume.

Big Chief—Development work is being driven ahead and the prospects for opening another body of ore in new territory are good. The mine, on Upper Carbonate hill, is shipping 50 tons daily.

Evelyn—The recent body of ore opened in an upraise from the east drift still persists. The drift is being driven from Boulder shaft to the Ball mountain fault. The mine is in South Evans gulch.

Tenderfoot—From this property, in South Evans gulch, 30 tons daily of sulphide ore is sent to the local smeltery.

Yak Tunnel—Connections have been made with Resurrection No. 1 shaft, and the lower levels are being cleaned out. The breast of the tunnel has passed the new Monarch shaft.

OURAY COUNTY

Sutton—The Slick Mining Company, operating this property at Mount Hayden, will drive a long development tunnel.

SAN JUAN COUNTY

New Gold King Mines—The land-slide on the Denver & Rio Grande road below Silverton has delayed the arrival of machinery for the mill and caused a suspension of work. Other mines in the San Juan district have been affected by the same condition.

TELLER COUNTY

American Eagle—Active operations have been resumed. The shaft is 1510 ft. deep, the deepest on Bull hill. Prospecting has been carried on for some time and one of the richest orebodies in the history of the mine found at the 1100-ft. level.

Half Moon—Work will be resumed on the body of shipping ore disclosed by explorations.

Chicago & Cripple Creek—Shipments have commenced from the tunnel in Poverty gulch.

Illinois

WILLIAMSON COUNTY

Big Muddy—The production of this mine at Herrin for the last fiscal year is reported to be 512,176 tons, which gives it first place in output in the State.

Indiana

PERRY COUNTY

All the coal mines are working from three to five days per week. There are a number of small or hill mines in this district and these are being worked for home consumption.

Troy Coal Mining Company—This company has been incorporated at Troy to do a general coal-mining business. The incorporators are H. L. Williams, J. M. Butler and Aaron Butler.

CLAY COUNTY

Coal Bluff—At one of the mines near Fontanet the company will sink a shaft to the deep or Mitchel vein.

Bee Ridge Block Coal Company—This company has been organized at Brazil by John E. Robertson, Andrew T. Spears, Lloyd Robertson and William G. Spears.

PIKE COUNTY

Indianapolis capitalists have obtained options on 2000 acres of coal land in Marion township near the Southern railroad. The price is $40,000 an acre for the mineral products.

The Oakland oilfield continues to receive attention. Several 100-barrel producers were drilled in during the past week. There are now 320 producing oil wells in Indiana. In 1908, 2,283,620 barrels were produced and valued at $3,203,883.

Kansas

CHEROKEE COUNTY

Illinois—George Boughton is installing pumps on a 20-acre lease on this tract and will work a lower level than heretofore. The zinc and lead runs have been under water several years. A mill will be built.

Gerster & Stone—This company, operating on the Southside land, has completed extensive preliminary work and resumed operations with an enlarged mill. One of the improvements is an aërial tram, 375 ft. long, capable of supporting 1000-lb. buckets.

Vest—J. P. Vest and others have begun drill prospecting on a lease on the Illinois tract. The work has disclosed good ore from 103 to 120 ft., continuing in varying richness to 150 feet.

East Galena—J. M. Pollard and C. L. Sawyer the past week encountered rich zinc dirt at 80 ft. on new land. From the same shaft considerable zinc silicate has been mined.

McAllister—The company's mill on the Sweeney land, south of Baxter Springs, is being overhauled and new machinery added. Development work on the lease shows a run of high-grade zinc rock averaging 30 ft. in thickness.

Michigan

COPPER

Ahmeek—The company is outputting 2000 tons of rock daily from two shafts, a production per shaft not equaled elsewhere in the district. The rock carries about 24 or 25 lb. of copper to the ton.

About 1700 tons of this output are being treated at the Franklin and Tamarack mills and the balance is being handled at the Calumet & Hecla mill on a test run. The two new shafts at the north end of the property are down about 250 feet.

Franklin—The shaft on the Pewabic lode is nearing the 27th level. At the 26th level over 100 ft. of drifting has been done with the lode well mineralized throughout.

Atlantic—Section 16 shaft is down to the 25th level and from this point extensive explorations will be carried on. This shaft has gone down in a badly shattered formation. No lateral openings were extended below the 20th level. At the fourth level a crosscut has cut the Baltic lode a short distance from the shaft, showing a 20-ft. width and good indications. Drifting at this point is under way.

Quincy—The fourth head at No. 1 stamp mill has been equipped with an enlarged cylinder. The enlarging of the cylinders from 20 in. to 24 in. on the single stamp heads has increased the capacity to about 710 tons per 24 hours. Plans are being prepared for the enlarging of the wash end of the mill.

Section 12—Plans are perfected for the organization of a company to explore the tract adjoining the Isle Royale on the south and believed to carry the extension of the Baltic lode. Diamond drill work will be undertaken.

Indiana—This company has started diamond-drill operations. Two outfits are in commission.

Isle Royale—Sinking has been resumed at "A" shaft on the Baltic lode, below the 500-ft. level, at which point it was temporarily suspended, while extensive lateral openings were made, without results. The shaft is now a few feet below this point and copper has appeared in the shaft. Several drills have been discontinued in the shafts of the main mine and for the present operations will be confined to the mining of the higher grade of rock, the copper contents of the rock not being sufficient to warrant the extensive openings that were being carried on.

Adventure—The new vertical shaft to open the three amygaloid lodes that were exposed in the drill cores is down 100 ft. in the ledges and from now on, greater progress can be made in sinking. It is calculated that the first formation will be cut at a depth of about 900 ft. This company has exposed the new Mass lode by means of trenches and it carries some copper.

IRON—MARQUETTE RANGE

Cleveland Cliffs—Surveys are completed for an electric transmission line connecting the Princeton, Maas and the North Lake mines. Generators operated by steam turbines will be installed at the Maas and Princeton. Each plant will be 1500 kw. It is the intention to eventually connect all the mines with this system, using two central power stations. The North Lake shaft No. 1 is 98 ft. deep, while shaft No. 2 was started last week. These two shafts open a new section about 3 miles west of Ishpeming. Foundations for a power house and steel head frame for shaft No. 1 are now being put in. The two shafts will be 500 ft. deep.

Kloman—Two diamond drills are at work prospecting this old property at Republic. It is now under the management of the Cleveland Cliffs company.

IRON—MENOMINEE RANGE

Trader's—The Antoine Iron Company is mining approximately 1000 tons of ore per day. The surface milling system is employed. Frank Carbis, Iron Mountain, is superintendent.

Chapin—The Cornish pump which has not been in use for a number of years has been installed in the Ludington shaft. It has a capacity of 3000 gal. per minute and will pump from the 1500-ft. level. There are eight lifts of 192 ft. each; stroke, 10 ft.; size of water column, 28 in.; the plunger is solid steel, 7 in. in diameter and 1536 ft. long; the weight of plunger and connecting rod, 182 tons; balance wheel is 40 ft. in diameter and weighs 162 tons.

Missouri

JOPLIN—ZINC-LEAD DISTRICT

Mercantile—The company is building a 250-ton mill north of Webb City. This is the sixth plant operated by the company. Robert Douglas, of Joplin, is manager.

Center Creek—S. Y. Romage, of Webb City, will build a second 300-ton mill on the Morgan tract.

Excelsior Zinc and Lead Company—This company has purchased 1032 acres of undeveloped ground in the Joplin district for $100,000. The company will drill the land and sublease. D. V. Sholl, of Joplin, is manager.

Granby—At Oronogo, the company has leased 45 acres to H. Tonkin, of Joplin, and two concentrating plants will be erected.

Lead, Baryte and Mercantile Company—This company has been organized at Potosi, Mo., with a capital of $5,000,000. Edwin J. White, of Yarmouth, Mass., is at the head.

Montana

BUTTE DISTRICT

Butte Coalition—The August output was 3,000,000 lb. It is expected that this rate of production will be maintained in the future.

Bamar Copper—The raise on the Linda claim from the tunnel to the surface has been completed and sinking on the two-compartment shaft begun. The company will sink to a depth of 500 feet.

BEAVERHEAD COUNTY

Pioneer—At a recent meeting of directors it was decided to contract for the running of a 200-ft. tunnel on the property near Jackson.

Calumet-Montana Mining Company—The company has recently been formed by Minneapolis people to operate the Dark Horse mine. Twenty-four men are now at work on three shifts. J. H. Lanyon is in charge.

BROADWATER COUNTY

Ohio-Keating—The incline shaft, being sunk on the lead, is now down 175 ft. No ore is being shipped and the work is confined to development, which will continue to 250 ft. A new five-drill compressor has recently been installed, and an 80-h.p. gasolene engine ordered. Barton Mitchell, of Radersburg, is superintendent.

MADISON COUNTY

Tri-State—The company has recently purchased the Broadway mine, near the Silver Star. The management states that operations will be begun within 60 days.

POWELL COUNTY

Elliston—The tunnel on the Flagstaff claim is now in 450 ft. It cuts a vein 10 ft. wide 400 ft. from the portal and at a depth of 280 ft. Fifteen carloads of ore have been shipped.

SANDERS COUNTY

French Bar—The principal work of the company has been done on the Messenger claim near Trout creek, where a shaft has been sunk 180 feet.

Nevada

ESMERALDA COUNTY—GOLDFIELD

Pittsburg Nevada Mining—Crosscutting at 400 ft., a lode has been found from which assays running from $8 to $14 per ton have been obtained.

Combination Traction—The output for August was 2340 tons having a gross value of $57,790. A new vein has been opened on the 387-ft. level.

Atlanta Mines—Upon the Cherokee lease a station has been cut at 615 ft. in the shaft, and a crosscut is being driven to intersect the vein cut at 514 ft. while sinking.

LANDER COUNTY—AUSTIN

Austin-Manhattan Consolidated—Work is resumed at the Union shaft and all the old workings will be unwatered. J. H. Humes is superintendent.

LINCOLN COUNTY

Bamberger-Delamar—This mine has been permanently closed. It is 35 miles southeast of Caliente. Dry crush-

ing was tried but the fatalities were numerous from the dust.

Santa Barbara Company—A concentration plant will be erected in Eldorado cañon.

Colorado River Dredging Company—A dredge will be installed at the mouth of Vegas wash by this company, which is now operating a gold dredge near Eldorado cañon handling 3000 yd. per day.

LINCOLN COUNTY—PIOCHE

Smeltery—It is authoritatively stated that sufficient funds have been subscribed for the construction of the proposed smelting plant for this district and that the project now hinges on the conclusion of certain subsidiary negotiations.

Nevada-Utah and Ohio-Kentucky—These important silver-zinc-lead mines at Pioche have practically concluded negotiations for consolidating the properties.

NYE COUNTY—ROUND MOUNTAIN

Round Mountain Mining—The company has declared a dividend of 4c. per share. This makes a total of $192,812 paid.

Blue Jacket—Carl Stofelt, Willard Morgan and Harry Cook have made a first shipment from this lease.

NYE COUNTY—MANHATTAN

Manhattan-Thanksgiving—The shaft will be sunk from 350 to 500 ft., making the deepest shaft in the camp. The ore found is not amenable to cyanidation. G. T. Stanley is manager.

WHITE PINE COUNTY—ELY

Butte & Ely—The Cole-Ryan option has been taken up for the Giroux Consolidated.

New Mexico

GRANT COUNTY

Chino—Eight churn drills are at work on this property and 140 holes, spaced 100 ft. apart, have been put down; the results of the drill cores are being checked by underground work, and raises and crosscuts in the Santa Rita orebody have checked closely with the drill-hole samples. The company's engineers estimate between 4,000,000 and 5,000,000 tons "in sight" and about 2,500,000 tons as "probable ore." On the company's holdings of about 3000 acres, six main orebodies have been disclosed, some of which will be amenable to steam-shovel mining and for the others the caving system is expected to be used. Of the six orebodies the Romero, Montoyo and Chino are to be mined by the former method and the Hearst, Texas Flat and Whim Hill orebodies by some form of the caving system. The property is notable for the variety of the ores, which vary from sulphides to native copper, the latter being particularly in evidence on the Santa Rita group. The ores developed range from 2 to 3.25 per cent. copper, averaging about 2.5 per cent. An extraction of 70 per cent. has been estimated from weekly runs in the experimental mill at the property. The mine work is in charge of John M. Sully at Santa Rita, N. Mex.; A. Chester Beatty, of New York, is consulting engineer.

Mangas Development Company—This company has been organized to develop a group of claims between the Burro Mountain and Chemung mines in the Burro mountain district near Silver City. The property has been examined by J. Morgan Clements, who has recommended prospecting by churn drills for which an appropriation of $100,000 has been made. Judge Norman W. Haire, of Houghton, Mich., formerly general manager for the Bigelow properties, is interested.

LINCOLN COUNTY

Parson—J. H. Fuller, of Mishawaka, Ind., has purchased this mine at court sale for $35,000 and will operate it.

North Carolina

Ashboro Gold Mining Company—The old Tucker mine, two miles from Ashboro, N. C., has been purchased by this company, and machinery is being installed. The ore is in decomposed rock and will be treated by log washers.

Oklahoma

A lead and zinc discovery has been made in the Ozark hills, Cherokee county.

Oregon

DOUGLAS COUNTY

Myrtle Creek—J. E. Overman of Roseburg, Ore., is operating a lode mine at Myrtle creek.

LANE COUNTY

Sweepstake—This mine at Bohemia will install a 10-stamp mill. John Brund is owner.

North Fork—A stamp mill is being erected at this mine between the Blue river and Bohemia. J. Christie, of Eugene, Ore., is manager.

Combination Mines—The company is installing machinery at Bohemia and carrying on development. Sherman Clark is engineer.

Dean Cabin—Lewis Hartley will open up this mine near Bohemia.

South Dakota

LAWRENCE COUNTY

Homestake—The total increase for the year ended May 13, was $6,309,572, of which $2,042,000 was net income. Dividends declared amounted to $1,121,000. Work is in progress on a hydro-electric installation that will cost $1,000,000.

Utah

BEAVER COUNTY

Black Bird—A core drill will be used to prospect the lime-granite contact. The mine adjoins the Newhouse. B. N. Lehman is manager.

Nevada Ready Pay—Development has been started after extensive explorations.

Newhouse—The South Utah Mines and Smelters will be the title under which this property at Newhouse will be operated after the foreclosure proceedings have been completed.

King David—At 525 ft. a change of formation is coming in. Work is being actively carried on in charge of David Evans.

BOX ELDER COUNTY

Little Butte—Work on a 200-ft. shaft has been begun. The mine is in the new Lucin district on the Utah-Nevada line.

JUAB COUNTY

East Tintic Development—The shaft is now at the 500-ft. level. Four cars have been taken from the rich strike made recently.

Bullion-Beck—High-grade lead-silver ore has been struck on the 300-ft. level. The property belongs to the United States Smelting, Refining and Mining Company and supplies low-grade flux.

May Day—Ore has been found at the 1000-ft. level and the shaft will be sunk 100 feet.

Uncle Sam Consolidated—The usual dividend of 2c. a share, amounting to $10,000, has been declared.

Tintic Smeltery—The plant will close an account of lack of ore and the output of the Knight company will be diverted to Bingham Junction.

SUMMIT COUNTY

Daly-Judge—An important strike has been made at the 1400-ft. level.

New York—Quartzite has been struck at 845 ft. and the mine drained, saving the expense of three pumps.

Washington

FERRY COUNTY

Black Tail—Twelve carloads of ore have recently been shipped from this property near Republic and the company contemplates increasing the equipment.

West Virginia

A deal involving $10,000,000 in timber and coal lands in Boone, Raleigh and Logan counties has been closed at Charleston. The deal is financed by a railroad company, the identity of which is not yet made public.

BARBOUR COUNTY

Sterling Coal Company—This company

has been organized with $2,750,000 capital. F. M. Kirk, of Wheeling, is in charge.

MONONGALIA COUNTY

Elkins Coal and Coke Company—The coke ovens at Bretz and Richard have been fired, the company having taken a contract to supply coke to the Maryland Steel Company.

PRESTON COUNTY

Preston County Coke Company—The first block of 140 coke ovens at Cascade has been completed and fired. There are 160 more ovens under contract, to be built at once. The coke is shipped to La Belle Iron Works at Wheeling.

Wisconsin

ZINC-LEAD DISTRICT

Kennedy—The company's two mills are now turning out 50 tons of 40 per cent. zinc and 10 tons of lead concentrates daily; recent drilling has proved the deposit for 700 feet.

Vinegar Hill—At Hazel Green, the company has started shaft sinking on the Kennedy land, which showed rich borings of lead and jack.

Canada

BRITISH COLUMBIA—HEDLEY

Nickel Plate—The mine at Hedley, B. C., formerly owned by the Daly estate, of Montana, has been acquired by the Hedley Gold Mining Company, of which W. E. Corey, T. F. Cole, C. A. Congdon, I. L. Merrill, George E. Tener, James Hoatson and C. D. Fraser are the executive committee. The property is 20 miles from Karamoes, B. C. It consists of 16 claims and has a 40-stamp mill, concentrator and cyanide plant. A sliming plant will be added, and development pushed extensively by the new owners. The mine has a record of $900,000 net profit, and is now earning $200,000 yearly. The ore runs from $11 to $15 per ton, and a saving of from 85 to 90 per cent. is now made.

BRITISH COLUMBIA—BIG BEND OF COLUMBIA

Twenty men are developing a deposit of mica, on Yellow creek, a tributary of the Columbia river, which enters on the northeast side of the big bend. The mica is of good quality, but transportation facilities will have to be provided before shipment to market at reasonable cost will be practicable.

BRITISH COLUMBIA—GREENWOOD

British Columbia Copper—The company has purchased a control in the New Dominion Copper Company. The Dominion ores will be smelted at the British Columbia smeltery, which will be enlarged.

ONTARIO—COBALT

Latour Lake—In this section, on the Wright claim, a vein 1 in. wide, with high silver content, has been discovered. The Lang-Caswell has made a discovery of a new vein of cobalt ore.

Station Grounds Mining Company—A diamond drill has been started opposite the post office to prospect under Cobalt square.

Crown Reserve—A concentrator will be erected by this company. There are 15,000 tons on the dump. The vein in depth is split and yields low-grade ore.

Trethewey—The concentrator for this mine is under way; an electric tram is being built to connect the mill and mine.

ONTARIO—GOWGANDA

Blackburn—Ore will be shipped as soon as the roads freeze. The mine is at Miller lake in the Gowganda district.

NOVA SCOTIA—SYDNEY

Dominion Iron and Steel—The production for three months shows an increase over last year, despite the shortage in fuel because of the coal strike. The June, July and August output is as follows: Pig iron, 68,237; ingots, 80,529; blooms, 71,404; rails, 46,854; rods, 19,276 tons.

Mexico

CHIHUAHUA

Descubridora—This mine, about five miles from Chihuahua, is again producing at the rate of 100 tons daily. The product is shipped to the local plant of the American Smelting and Refining Company. Krafft Brothers are the owners.

Yoquivo—J. S. Qualey & Co. have lately purchased a small cyanide plant for immediate installation at this property in the western part of the State. Stamp-crushing in cyanide solution followed by fine grinding in tube mills will be practiced.

Sierra Consolidated Mines Company—The Cole-Ryan interests have organized this Arizona corporation for the operation of the Colonel Greene and adjoining properties in the Ocampo section. The main properties are those of the old Belvanera, Belen, Eduviges, San Ramon and El Refugio. Active work will be started at once under the supervision of Dr. L. D. Ricketts, general manager of the Cananea Consolidated Copper Company. The company will be capitalized for 300,000 shares of $10 par value, although only $6 will be called for at the start. The properties, it is stated, will be turned over to the new company at cost, no promoters' shares being issued.

Inglaterra—Ore was lately marketed from this mine in the Santa Eulalia camp, and on the returns therefrom will depend the amount of early shipments and the nature of future developments. J. C. Shepherd is manager.

San Francisco del Oro—This mine at Parral has shipped 500 tons of ore to Wales for experimental treatment.

Capazaya—This company, promoted by Britton Davis, of Washington, D. C., is settling claims against the property, presumably with the intention of resuming. The company has mining ground adjoining the Palmilla and has expended large sums so far without finding an extension of the Palmilla orebody.

Parral Consoldiated—The Prieta mill at Parral is under construction.

DURANGO

Lustre—At a meeting in Pittsburg, it was decided to accept the proposal of S. H. McKee, Augustus Hartje, Robert L. Stevenson, R. W. Bissell and C. A. Cooper, to advance $165,000 at once to prevent Mexican creditors from foreclosing the property, control of which may be reassumed by the stockholders at the end of six months upon repayment of the above sum and giving security for several hundred thousand dollars due Pittsburg creditors. The property is about 50 miles from the railroad.

GUANAJUATO

Guanajuato River Mill—The Guanajuato River Company has been formed to install a cyanide plant for treating the lower river tailings. About 600,000 tons of tailings are measurable above the dam, said to average $3 in gross value, of which about 65 per cent. is gold. The tailings are quite free from sewage contamination, and are in a deposit averaging 25 ft. in thickness. Below the dam are several million tons of tailings which are more scattered. The company is controlled by the same interests which are in the Guanajuato Development Company. Plans are made for a large mill installation. The tailings will be treated without grinding or other preparation.

JALISCO

San Vicente—A cyanide plant is to be installed at this mine at San Martin Hidalgo, M. J. Slattery, manager. Recent tests of the ore, which is refractory and supposed to contain tellurium, have demonstrated the availability of cyanidation.

SONORA

Cienguita—Negotiations are under way for the building of the Cienguita & Sonora Central railroad from Tonchi on the Rio Yaqui line of the Southern Pacific. The distance is 70 kilometers.

El Tigre—The option to Leggett & Hellmann, of New York, on this mine was allowed to lapse after examination. The price was between $5,000,000 and $6,000,000. Over 2000 samples were taken in the examination.

Metal, Mineral, Coal and Stock Markets

Current Prices, Market Conditions and Commercial Statistics of the Metals, Minerals and Mining Stocks

QUOTATIONS FROM IMPORTANT CENTERS

Coal Trade Review

New York, Sept. 15—A large amount of coal is being used in the East. The demand on the Atlantic seaboard is improved but irregular. The car shortage continues to bring forth complaint, although promise of improvement is held forth in this direction.

Car shortage is also complained of in Illinois. In this district prices continue to hold firm, with medium demand. The South reports better production and steady movement. The labor situation here is giving no trouble. Southern States are using much coal from the Birmingham district, although the bulk of the output is used by the railroads.

The Western demand is improving, with a tendency to hardening prices. Labor shortage is reported from some localities but conditions are improving in this respect. Connellsville coke is in strong demand, with higher prices for all deliveries.

There seems to be a general expectation of higher prices in the near future in all districts.

The demand for anthracite continues to improve, with prices about the same.

Coal Traffic Notes

Coal tonnage of Chesapeake & Ohio railway, short tons: July, 1909, 1,109,446; July, 1908, 976,749. Coke: July, 1909, 34,813; July, 1908, 22,349.

Coal and coke tonnages originating on Pennsylvania Railroad lines east of Pittsburg and Erie, year from Jan. 1 to Sept. 4, short tons:

	1908.	1909.	Changes.
Anthracite	3,435,533	3,245,711	D. 189,822
Bituminous	22,063,146	24,343,692	I. 2,280,546
Coke	4,613,678	7,057,313	I. 2,443,635
Total	30,112,347	34,646,716	I. 4,534,369

The total increase this year to date was 15 per cent.

New York

Anthracite

Sept. 15—Demand for anthracite coal continues to increase. There has been a decided improvement in business during the past 10 days. Prices are the same at $4.75 for lump and $5 for egg, stove and chestnut, f.o.b., New York harbor. For steam sizes prices are unchanged, quotations being: Pea, $3.15@3.25; buckwheat, $2.35@2.50; No. 2 buckwheat or rice, $1.70@2; barley, $1.35@1.50; all f.o.b. New York harbor.

Bituminous

The Atlantic seaboard soft-coal trade shows some improvement in demand, although this improvement is rather irregular and hence unsatisfactory. The question of car supply seems to be becoming a feature of the trade, and serious complaints are heard on several of the roads.

The general impression prevails that this situation is temporary and will work out satisfactorily in a few weeks.

Trade in the Far East is calling for quite an amount of coal in small lots from all over that territory. It is not thought that there is much stock on hand, except in those plants that are prevented from getting coal during the winter months, and have consequently been foresighted in taking advantage of the low water-freight rate that has prevailed. Along the Sound the trade is calling for many small lots of coal. These orders coming with urgent instructions for prompt shipment indicate that the plants are not well stocked.

Trade in New York harbor is picking up slightly, some little current business being transacted, but prices continue low. During the past week ordinary steam coal could be bought at $2.25 f.o.b. New York harbor shipping point, with some better grades coming down to that figure in order to get rid of surplus stock on hand. Good grades were selling at $2.50@2.60 f.o.b. New York harbor shipping point. Slack sold at 50@60c. f.o.b. mines.

During the Hudson-Fulton celebration the Hudson river will be practically closed to navigation, and shipments in this locality are accordingly being rushed to cover contingencies. Transportation from the mines to tide is still not quite up to schedule. Car supplies to the Virginia capes and on the Baltimore & Ohio is poor. Stringent regulations maintained in this particular by the Baltimore & Ohio over small mines are chafing owners.

The coastwise vessel market is a shipper's market at this time. Low rates continue to be quoted as follows: From New York harbor around Cape Cod, 50@55c. per ton; from Philadelphia around the Cape on large vessels, 50@55 cents.

Birmingham

Sept. 13—The coal production in Alabama is much better than it was a month ago, and there is a steady movement of the product out of the district. It is announced on the best authority that the mining companies in this State are receiving more orders every week and the prospects are bright that there will be a steady output at the mines. It is acknowledged by several of the mining companies that prohibition in this State has had much to do with improving labor conditions. There is no trouble in getting labor now, though there is no telling what will be the case when the mines are in full operation. The reports at the office of the State mine inspector indicate that there are many men yet unemployed.

There was some coke accumulated during the past 12 months, but this is being worked down rapidly. The resumption of operation at coke ovens is increasing the requirements of coal. The winter demands are going to be steady and a large quantity of coal will be necessary to meet the needs. Much coal is being shipped to southern States from the Alabama mines.

Chicago

Sept. 13—Increasing sales and strength everywhere on bituminous, except fine coals, characterize the wholesale coal market. Screenings are nearest to being weak and the lower-grade run-of-mine from Illinois and Indiana mines comes next. The market for lump and egg is rapidly improving, though domestic business is not expected to be brisk for another month. Coals from east of Indiana share in the improved demand and hardly any shipments from Eastern or Western mines are sacrificed to escape demurrage charges. Any large shipments to this market of any kind of coal, however, would probably restore the old conditions of surfeit and low prices, so nearly is the amount received now adjusted to demand.

Prices on bituminous are firm, but can hardly be said to be advancing generally. Lump and egg from Illinois and Indiana bring $1.75@2.40, run-of-mine from the same States holds to $1.60@1.75, while screenings are quiet at $1.20@1.45.

Smokeless lump and egg brings $1.25@1.50 at the mines, or $3.30@3.55 Chicago; smokeless run-of-mine, so long over-abundant, is 90@95c. at the mines, or $2.95@3 Chicago, these prices being on Pocahontas and New River. Hocking at $3.05 is in fair demand and moves steadily. Gas coals are quiet and firm, Youghiogheny ¾-in. gas selling for $3.15.

Anthracite sales are increasing slowly and are well distributed, with all sizes in

good supply. Coke is active, with large sales and no oversupply, the best Connellsville bringing $4.85 per ton.

Pittsburg

Sept. 14—Demand for coal has improved both from retail dealers and from manufacturers and prices show a slight further stiffening. It is not improbable that there will be an advance in official prices within three or four weeks. Present prices, for mine-run at mines, are $1.10 to manufactureres and $1.20 to retail dealers, these prices being sometimes shaded 5 to 10c. per ton. Slack is officially 65c., and this price is being fairly well maintained.

Connellsville Coke—The market has continued to gain in strength, prices being higher for all deliveries. The Connellsville region has been suffering severely from a labor shortage which prevents as rapid an increase in operations as is desired, although there has been a steady improvement. Thus far production has been considerably short of the actual capacity of the region on account of the labor scarcity. Maximum production in a week thus far this year was in the week ended Sept. 4, when it was reported 421,320 tons were made. The maximum production reported in 1907 was 429,127 tons, at a time when there were reported 34,850 ovens in existence, with 33,195 in blast. At present there are listed 38,558 ovens, which in proportion to an utput of 429,127 tons with 34,850 ovens in existence, would give 475,000 tons, the best production shown this year falling 11 per cent. short of this.

Prompt coke has practically disappeared from the market and can be had only on the same price basis as coke over the fourth quarter, $2.40@2.50 for furnace and $2.50@2.60 foundry. Coke has advanced an even dollar a ton since the low point, made in the second quarter. Producers are chary about quoting for next year, but occasionally quotations are made ranging from $2.50 to $2.75 for furnace or foundry.

The *Courier* reports the production in the Connellsville and lower Connellsville region in the week ending Sept. 3 at 421,320 tons, an increase of 5000 tons from the previous week, and shipments at 5221 cars to Pittsburg, 7497 cars to points west of Pittsburg and 861 cars to points east of Connellsville, a total of 13,579 cars, or a gain of 367 cars from the previous week.

St. Louis

Sept. 13—That the long anticipated car shortage is already with us there can be no doubt. Reports from Illinois mines show that nearly all of those in southern Illinois lost two days or more last week on account of car shortage. The shortage was also felt in central and northern Illinois fields but not so keenly. The Illinois Central and Iron Mountain operators seem to have suffered the worst. Officials of the Illinois Central railway say that the trouble is only local, and that they expect to have the situation temporarily relieved next week, though later in the season they fear there will be a serious shortage. The demand at present is not heavy so we may expect serious trouble on account of the car question in October.

Though the demand is medium, there has been comparatively so little coal on the market during the last week that prices have been firm. Both prices and demand are improving slowly but surely. The market on lump is quite strong, but central Illinois operators are having some difficulty in moving egg and are offering liberal concessions on it.

Operators in the Staunton-Mt. Olive district have advanced their prices to $1.20 per ton f.o.b. mines for lump, or $1.72 per ton f.o.b. St. Louis. Egg and nut can be had at from 10 to 20c. per ton under this figure. The Standard mines are running much better than heretofore, and are realizing much better prices for lump; screenings, however, have come down so much that the mine-run is not netting the operator a cent more than it did when lump was bringing much less money. Standard 3-in. lump is bringing 85c. per ton f.o.b. mines, or $1.37 f.o.b. St. Louis. Preferred grades of 6-in. standard lump are bringing from $1@1.10 f.o.b. mine, or $1.52@1.62 f.o.b. St. Louis. Three-inch nut is bringing about 65c. per ton f.o.b. mines, or $1.17 f.o.b. St. Louis, while 2-in. screenings are down to 30c. f.o.b. mines, or $0.82 per ton f.o.b. St. Louis.

Six-inch Carterville lump or egg is bringing $1.25 per ton f.o.b. mine, or $1.92 per ton f.o.b. St. Louis. Franklin county coal is bringing from 15 to 25c. per ton more. Three-inch nut from this district is going around $1.15 per ton f.o.b. mine, or $1.82 per ton f.o.b. St. Louis, while 1½-in. screenings are bringing from 40 to 50c. per ton f.o.b. mines, or $1.07@1.17 per ton f.o.b. St. Louis.

The demand for washed coal is good for all sizes except No. 5, which is not moving as well as the other sizes. Several washers report that they are sold up for a month ahead on Nos. 1 and 2. The situation on the whole looks bright. Coal of all grades will doubtless increase in price at an early date.

Iron Trade Review

New York, Sept. 15—In the East there is active demand for all grades of pig, prices being slightly higher. The finished-product market is less active.

In the South and Southwest the demand for pig is strong and increasing. Most sales are made at $14 for No. 2 foundry, although in some cases $14.25 and even $14.50 is being asked. In the Birmingham district the raw-material conditions are satisfactory and several furnaces are preparing to go in blast. Improved industrial conditions have increased the demand for finished products. Higher prices are expected at an early date.

The West reports improving demand and an upward tendency of prices generally. Heavy sales are made in all lines of iron and steel. Prices show an advance of from 25 to 50c. per ton, with deliveries for 1910 quoted at from 50c. to $1 above present prices.

Birmingham

Sept. 13—Southern pig-iron prices are advancing, demand continues strong and business is placed well into the first quarter of the coming year. Immediate delivery is not easily procured in this district save at the strong prices that have been prevailing during the past week. The prices have settled on a basis of $14 per ton, No. 2 foundry, with $14.25 and $14.50 per ton being asked and two or three orders already taken in at that price. The make is to be improved at once in this territory. The torch has been applied to one furnace in the last few days and two others are to be started up before the end of the month. The Southern Iron and Steel Company alone will start up three furnaces during October. The Tennessee, Sloss-Sheffield and Republic companies each are to start up one furnace before the last of the month; the Sloss-Sheffield will have a second furnace ready for operation immediately after the turn of the new month. Reports which are given out freely here are to the effect that there is hardly any apprehension felt that the raw material will not come up to all requirements.

Home consumption continues steady. It is announced that the cast-iron and soil pipe plants and the steel plant of the Tennessee company, at Ensley, will be able to operate for nine months to come at least on business that is in hand; with business in sight it will be necessary to put the plants on full time and operate double shifts in some departments. The Tennessee company is still receiving orders for steel rails; the production is healthy and the output is being shipped away about as rapidly as it is ready to be loaded on cars. Southern railroads are using steel manufactured in this district.

Chicago

Sept. 13—Strong conditions continue everywhere in the iron market, with prices tending upward and the average melter buying pig iron liberally for first-half

needs. Last-quarter needs are pretty well supplied, but such iron as is needed is bought at about 50c. less than is paid for 1910 deliveries.

Selling agents say they are not anxious to sell at the prices current, being confident that the market is bound to grow stronger. Minimum prices may be considered $18.50 for Northern and $14 Birmingham ($18.35 Chicago) for Southern. At these prices Northern is comparatively the stronger, though both kinds may be considered very strong. Sales are for larger amounts, in general, and the occasional large order is more frequent. The carload lot sales for quick delivery are comparatively few, nearly every melter being inclined to buy more and more for the future. Confidence in the future and in higher prices soon, indeed, marks the average buyer as well as the average seller of pig iron. Foundrymen have booked and are booking heavy orders for their products; they see only prosperity ahead.

All lines of iron and steel products have recorded heavy sales in the last week, railroad supplies and structural materials leading.

Philadelphia

Sept. 15—All kinds of pig iron are in active demand at hardening prices. One cause of the activity is the reflex influence of conditions in western Pennsylvania. The most active raw material is basic pig. Large orders have been placed during the past week and today buyers are awaiting answers to propositions made a few days ago. A great anxiety prevails in this territory concerning the future of basic because of incoming business which calls for basic material. A further advance is considered the logical outcome of the present situation. Bessemer is quoted 50c. higher. Foundry iron is 25c. higher in actual selling price than a week ago. This has temporarily discouraged some taking, but foundrymen are recognizing that the situation is against them and they will not sulk in their tents very long. Sales of malleable were made at 50c. above the price of two weeks ago. Gray forge is strong and no higher. Mills are buying only as they need except in a few cases where contracts for pig run over into next year. Basic is quoted at $18.25; best gray forge, $17; inferior, $16.50; No. 2 foundry, $18; one or two brands slightly higher.

Steel Billets—Recent negotiations have resulted in the placing of several orders, large and small, for early and late delivery at manufacturers' prices, which are 25 to 30c. higher than previous orders. An advance is rumored and buyers are unable to get the prices and dates of delivery to suit their views.

Bar Iron—A further general improvement in demand is reported at all local offices and reports direct from mills in the interior indicate that business is pouring in, but for the most part for small orders. Mill men are not courting winter deliveries. Prices are firm. No advance is intimated, but from the tone of replies, manufacturers will not be slow to take better prices if they see the chance.

Sheet Iron—The moderate expansion in demand heretofore mentioned has increased and consumers are now buying for later delivery in larger quantities. Sheet bars are higher and there is greater pressure for all manner of sheet-mill products. The situation is gratifying to manufacturers and they are in no accommodating mood when asked to name prices for winter delivery.

Pipes and Tubes—Work in all the industries using tubes is piling in. The Baldwins have booked orders for about seventy engines within a few days. All the smaller establishments in eastern Pennsylvania are filling up and their orders are for quick delivery. Very little business is coming in for winter delivery.

Plates—No large orders are reported, but the usual rush of small orders is observed. Building enterprises and small engineering operations will soon be calling for steel plate for early winter. Prices are $1 per ton higher on small orders and concessions have been refused on large early winter work.

Structural Material—There have been no important developments in shapes, though a very large volume of business is within speaking distance, including bridge material, warehouse building and shipyard requirements. A general advance is believed to be close at hand because of the oversold condition of mills.

Steel Rails—No large orders have been placed. Small repairing orders are numerous.

Scrap—Dealers are once more securing stocks of scrap with a view of meeting any probable demand for the last quarter, which most of them anticipate will be heavy. It is probable that considerable of the Panama scrap will find its way to this port. Most buyers of scrap have but little on hand and dealers have managed to keep prices at a high level.

Pittsburg

Sept. 14—A strong advancing tendency continues to be manifested in pig iron and finished-steel products, and the trade is beginning to be seriously concerned with the question whether the improvement is not too rapid. It is less than seven months since the market broke and not more than five months since bottom prices were reached. There is no criticism of the present level of prices, which no one asserts is too high, but it is clear that the rate of advance of the past two or three months, if continued for any length of time, would carry the market up to an unsound level.

The mills are well filled with tonnage all along the line and do not need to encourage the placing of additional business, so that there has been a constant tendency to ask higher prices which buyers as a rule have been willing to pay, and thus the movement is continued. As a rule the buying is not by the largest interests, as they covered their requirements in the second quarter, and there is some concern as to what may occur when the contracts of such large interests expire and the question of renewal comes up at a time when the general market is so much higher.

The Carnegie Steel Company has issued a new list of extras on steel bars, effective Sept. 1. The extras are approximately half those in the former list, upon which list the rule of half extras applied, so that superficially there is no great change, but in some quarters it is held the new list will tend to cut down jobbers' profits, as jobbers frequently charge full extras on small lots. It is inferred that the promulgation of the new list is in connection with the United States Steel Corporation's plan of eventually having a string of warehouses of its own in the principal distributing centers.

The Carnegie Steel Company has finally withdrawn its price of 1.35c. on bars, and now quotes nothing below 1.40c., while on less desirable business it quotes 1.45c., these prices having been quoted by most of the independents for some time. The 1.40c. price on plates and shapes has disappeared, leaving the market at 1.45@1.50 cents.

Ore—The more optimistic among ore producers predict that the Lake Superior ore movement this season will break the 1907 record, when 42,000,000 tons was exceeded. Shipments down the lakes to Sept. 1 amounted to 22,588,549 tons and estimates are made of 7,000,000 tons for September, 7,500,000 tons for October, and 6,500,000 tons for the remainder of the season, which would make a total of about 43,000,000 tons, not counting all-rail shipments. While there has been no formal discussion it appears to be the general impression that Lake Superior ores for next season will be advanced 50c. per ton, thus restoring the 1907 level, the highest since the discovery of the Mesabi range.

Pig Iron—Bessemer iron has occupied the center of the stage, transactions in the past week totaling 45,000 tons or more. The Jones & Laughlin Steel Company bought 20,000 tons from the Bessemer Pig Iron Association, at $17, Valley, or $17.90 delivered Pittsburg, for fourth-quarter delivery. A prominent merchant-furnace interest bought 20,000 tons from another furnace interest, for early delivery, at $16.75, furnace, the furnace not being located in the valleys. Total transactions in bessemer iron since Sept. 1 total between 70,000 and 75,000 tons, in which time the market has advanced from

$16.75@17, Valley. A meeting of the Bessemer Pig Iron Association will be held in Cleveland Thursday to discuss the Steel Corporation inquiry and other matters. Under the lead of bessemer all grades of iron have advanced in the local market, basic and foundry being firm at $16, Valley, while malleable is quoted at $16.25 and forge at $15.25, both at valley furnace. The advances are from 25 to 50c. in the week, and were accomplished without there being heavy sales.

Ferromanganese—The market is stronger, being quotable at $42.50 for this year and $44.50@45 for next year, f.o.b. Baltimore, the freight to Pittsburg being $1.95.

Steel—Unfinished steel is stronger, open-hearth billets being at a minimum of $26 at mill. Bessemer billets are nominally 50c. to a dollar lower. Sheet bars have sold at $27 at mill. Open-hearth rods have advanced and can hardly be had at less than $32 at mill, bessemer rods being about $31.50.

Sheets—The market continues firm, with mills well sold up. Prices remain at 2.20c. for black and 3.25c. for galvanized, 28 gage, corrugated roofing being $1.55 per square for painted and $2.80 for galvanized.

Metal Markets

New York, Sept. 15—During the past week the markets for lead and spelter have been dull, but toward the close there were signs of increasing activity in spelter. The copper market has been fairly active, especially in business for export, but at concessions in price. However, there seems to be a good buying power, and the decline is not expected to go further. The silver market was practically unchanged throughout the week.

Gold, Silver and Platinum

UNITED STATES GOLD AND SILVER MOVEMENT

Metal.	Exports.	Imports.	Excess.
Gold:			
July 1909..	$16,661,782	$ 3,269,885	Exp. $13,391,897
" 1908..	4,845,272	2,949,179	Exp. 1,896,093
Year 1909..	80,496,119	23,405,477	Exp. 57,090,642
" 1908..	58,363,098	29,357,075	Exp. 29,006,172
Silver:			
July 1909..	5,049,366	3,926,117	Exp. 1,123,249
" 1908..	4,930,746	3,039,581	" 1,891,165
Year 1909..	34,409,032	26,798,145	" 7,610,887
" 1908..	30,445,291	24,180,929	" 6,264,362

Exports from the port of New York, week ended Sept. 11: Gold, $39,443; silver, $747,895, chiefly to London. Imports: Gold, $109,834; silver, $39,443; chiefly from the West Indies, Mexico and South America.

Receipts of gold at the Australian mints for the half-year ended June 30 were, in fine ounces: Sydney, New South Wales, 246,880; Melbourne, Victoria, 420,655; Perth, Western Australia, 713,067; total, 1,380,602 oz. These receipts were 93 per cent. of the total reported production of the Commonwealth for the half-year.

Platinum—Our correspondent at St. Petersburg reports under date of Sept. 2, that the advance in price still continues, sales having been made in the previous week at 20,500@21,000 rubles. The large producers are standing aloof, looking for a further rise. Quotations at St. Petersburg are 20,500@21,000 rubles per pood; at Ekaterinburg, 5.2@5.3 rubles per zolotnik.

At New York, the expected stiffening of the market has materialized. Ordinary refined platinum is quoted at $25.50 per oz., with $29.25 for the hard metal.

Silver—The market continues to fluctuate between narrow lines. Although the price of silver seems well sustained, a slight decline has materialized.

SILVER AND STERLING EXCHANGE

Sept.	9	10	11	13	14	15
New York....	51⅛	51⅛	51⅛	51⅛	51⅛	51⅛
London.....	23¾	23⅞	23¾	23⅞	23¾	23⅞
Sterling Ex..	4.8645	4.8645	4.8625	4.8625	4.8620	4.8625

New York quotations, cents per ounce troy, fine silver; London, pence per ounce sterling silver, 0.925 fine.

Exports of silver from London to the East, Jan. 1 to Sept. 2, as reported by Messrs. Pixley & Abell:

	1908.	1909.	Changes.
India.....	£ 6,448,443	£4,305,700	D. £2,142,743
China.....	516,400	1,555,200	I. 1,038,800
Straits.....	90,510	82,800	D. 7,710
Total.....	£ 7,055,353	£5,943,700	D. £1,111,653

Copper, Tin, Lead and Zinc

Sept.	Copper. Lake, Cts. per lb.	Copper. Electrolytic, Cts. per lb.	Copper. London, £ per ton.	Tin. Cts. per lb.	Lead. New York, Cts. per lb.	Lead. St. Louis, Cts. per lb.	Zinc. St. Louis, Cts. per lb.
9	13 @13¼	12¾ @13	58¾	29⅞ @30	4.32½ @4.35	4 20 @4.22½	5 55 @5 60
10	13 @13⅛	12¾ @12⅞	58¾	29⅞ @30⅛	4.32½ @4 35	4 20 @4 22½	5 55 @5.60
11	13 @13¼	12¾ @12⅞	....	30 @30¼	4.32½ @4.35	4.20 @4.22½	5 55 @5.60
13	13 @13¼	12⅝ @12⅞	58¼	30 @30⅛	4.32½ @4.35	4.20 @4.22½	5.55 @5.60
14	13 @13⅜	12⅝ @12⅞	58 7/16	29¾ @30	4.32½ @4.35	4 20 @4.22½	5.57½ @5.60
15	13 @13¼	12⅝ @12⅞	58⅜	29⅞ @30	4.32½ @4.35	4.20 @4.22½	5 57½ @5 60

London quotations are per long ton (2240 lb.) standard copper. The New York quotations for electrolytic copper are for cakes, of the transactions made with consumers, ingots and wirebars, and represent the bulk basis, New York, cash. The price of cathodes is usually 0.125c. below that of electrolytic. The quotations for lead represent wholesale transactions in the open market. The quotations on spelter are for ordinary Western brands; special brands command a premium.

Copper—During the week beginning with Sept. 9, the offerings of cheap copper from speculative hands appear to have been cleaned up, although some Lake seems still to be available from those sources. However, while there has been less pressure from second hands there has been more from first hands, especially since the publication of the statistics on the 10th inst., which had a dampening influence on the market. Sellers who had previously held back then began to meet the market or to underbid their competitors. With one or two exceptions all of the producers have offered electrolytic at 13c., delivered 30 days, corresponding to a little less than 12⅞c., net, cash, New York, while some have been willing to contract for deliveries up to the end of the year at that price and have shaded it for prompt and early deliveries. At the concessions, a liberal business was done, particularly for export. Domestic consumers are holding back in the hope of still lower prices, although it is generally believed that consumption in this country has now reached a point that is very near to the best ever recorded. Quotations at the close are 13@13⅜c. for Lake copper, and 12⅝@12⅞ for electrolytic copper in cakes, wirebars or ingots. The average of the week for casting copper has been 12½@12¾ cents.

The market for copper sheets and wire remains unchanged, with sheets held at 17@18c., base for large lots, and wire at 15 cents.

The Copper Producers' Association reported on Sept. 10 the following statistics for August: Stock on hand Aug. 1, 122,596,607 lb.; production during the month, 120,597,234 lb.; deliveries for domestic consumption and export, 107,996,911 lb., of which 59,614,207 was for domestic consumption; stock on hand Sept. 1, 135,196,930 pounds.

For two or three weeks back the copper market has been somewhat disturbed by rather large offerings, both of lake and electrolytic, by second hands, which evidently were liquidating and in order to do so were willing, or obliged, to make concessions. Some producers, especially when they are holding out for higher prices, have affected to look scornfully upon the market conditions created by operations from second hands and say that they do not represent the market as between producers and consumers. Of course, this is a biased view. The speculators do not make their copper or transmute it from lead or any other cheaper metal, but buy it from first hands, who are frequently glad to sell to speculators as well as to manufacturing consumers. That being the case, it is amusing that some producers assume such an injured air when the unfortunate speculator has to resell.

The standard market broke sharply under the influence of the unfavorable statistics, the lowest prices being estab-

lished on Monday, when spot closed at £58¼ and three months at £59. Since then there has been better support, and the close is firm at £58⅝ for spot and £59½ for three months.

Refined and manufactured sorts we quote: English tough, £62; best selected, £61@62; strong sheets, £73@74.

Tin—In spite of the good business that is reported in all lines requiring tin, the tone of the market has been heavy throughout the week and the metal is actually offered at below the European parity. This situation must be due to speculative causes, which within a short time should be overcome. The close is steady at £136¼ for spot and £137⅜ for three months, while business here is being done at 29⅞@30 cents.

Lead—This metal has been practically neglected. The close is steady and unchanged at 4.20@4.22½c., St. Louis, and 4.32½@4.35c., New York.

The London market also closes unchanged at £12 11/16 for Spanish lead, and £12 13/16 for English lead.

Spelter—The market has shown a great deal of persistence at the lower prices established recently; in consequence, consumers are beginning to show interest and a firmer tone is being effected. The close is sensitive at 5.57½@5.60c., St. Louis, and 5.72½@5.75c., New York. The price at New York was 5.70@5.75 on Sept. 9-13, and 5.72½@5.75 on Sept. 14-15.

The London market has been buoyant, and the close is higher at £23 for good ordinaries and £23¼ for specials.

Other Metals

Antimony—The market is steady, quotations remaining at 8⅝@8¾c. per lb. for Cookson's, and 8@8¼c. for United States.

Aluminum—No change is noticed in the market for aluminum. No. 1 ingots can be had at 20@23c. per lb. in large lots with the American maker still holding to the higher figure.

Quicksilver—Demand is good and the New York market is strong at $44 per flask of 75 lb. Jobbers quote 60@62½c. San Francisco quotations are still $42@43 for domestic and $40@41 for export. The London market holds to £8 7s. 6d. per flask with the jobbers underselling.

Nickel—Large lots, contract business, 40@45c. per lb. Retail, spot from 50c. for 2000-lb. lots, up to 55c. for 500-lb. lots. The price for electrolytic is 5c. higher.

Magnesium—Quotations for the metal are $1.25 per lb., New York, in 100-lb. lots; for 5-lb. lots, $1.40 per pound.

Cadmium—Current quotations are 75c. per lb. in 100-lb. lots at Cleveland, Ohio. In Germany 450@475 marks per 100 kg., at factory in Silesia.

Zinc and Lead Ore Markets

Joplin, Mo., Sept. 11—The highest price paid for sulphide ore was $52 per ton, the base ranging from $47 to $49 per ton of 60 per cent. zinc. Zinc silicate ore sold up to $31 per ton, the base ranging from $23 to $25 per ton of 40 per cent. zinc. The average price, all grades, was $44.34 per ton.

Some lead was loaded out this week on purchases of one and two weeks ago, and while the highest offering of this week was $56.50, the average settling price, all grades, was $56.06 per ton.

The demand for all ores was exceedingly light all week. No ore was purchased until Thursday afternoon and the first offerings came from the sellers. All buyers had light buying orders and these were easily filled. With the heaviest output of the year the stock in bins throughout the district has increased rapidly the past three weeks of light shipments.

SHIPMENTS, WEEK ENDED SEPT. 11.

	Zinc, lb.	Lead, lb.	Value.
Webb City-Carterville	3,608,530	374,590	$ 95,288
Joplin	1,840,860	146,490	48,236
Prosperity	726,250	38,300	18,138
Duenweg	728,850	126,710	19,871
Galena	785,850	45,730	19,747
Carthage	124,970	.....	2,998
Oronogo	115,630	.....	2,544
Alba-Neck	221,070	.....	5,305
Sarcoxie	66,000	.....	1,518
Spurgeon	262,560	50,110	6,472
Aurora	626,380	.....	12,734
Badger	318,230	8,050	7,796
Zincite	152,630	.....	3,816
Quapaw	136,130	1,100	3,025
Cave Springs	62,310	.....	1,557
Miami	624,250	232,090	16,681
Granby	939,240	31,580	14,675
Carl Junction	211,430	.....	5,391
Stott City	52,790	.....	1,287
Wentworth	28,620	.....	499
Totals	11,632,410	1,054,750	$287,578
37 weeks	417,484,830	62,909,940	$9,800,205
Zinc value, the week, $257,957; 37 weeks, $8,087,250			
Lead value, the week, 29,621; 37 weeks, 1,712,955			

MONTHLY AVERAGE PRICES.

Month.	Zinc Ore. Base Price.		Zinc Ore. All Ores.		Lead Ore. All Ores.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	$37.60	$41.25	$35.56	$38.46	$46.88	$52.17
February	36.63	36.94	34.92	34.37	49.72	50.50
March	36.19	37.40	34.19	34.71	49.90	50.82
April	35.40	38.63	34.08	37.01	52.47	55.63
May	34.19	40.06	33.39	37.42	56.05	56.59
June	33.06	44.15	32.07	40.35	60.48	57.52
July	34.55	43.06	31.67	41.11	59.90	53.74
August	36.53	48.25	33.42	44.54	60.34	57.60
September	37.63	.....	34.44	.....	54.59	.....
October	35.95	.....	33.28	.....	52.63	.....
November	39.13	.....	35.02	.....	54.53	.....
December	42.75	.....	39.63	.....	49.68	.....
Year	$36.63	.....	$34.31	.....	$53.93	.....

NOTE—Under zinc ore the first two columns give base prices for 60 per cent. zinc ore; the second two the average for all ores sold. Lead ore prices are the average for all ores sold.

Chemicals

New York, Sept. 15—A quiet market and a slight shading of prices have prevailed during the past week.

Copper Sulphate—The market for copper sulphate exhibits no changes. Prices are still $4.22½ per 100 lb. in carload lots and $4.32½@4.47½ per 100 lb. for smaller orders.

Arsenic—The white arsenic market is still rather weak and prices have failed to rise as anticipated. Quotations are 2⅝@2¾c. pe pound.

Nitate of Soda—The market for nitrate of soda is extremely quiet with quotations at 2.10c. per lb. in all positions.

Mining Stocks

New York, Sept. 15—The news of Mr. Harriman's death which was first known after the close of the stock market on Thursday, was followed by a shrewd and unexpected bit of manipulation. London was used as a powerful lever for supporting prices before the market in New York opened. The sentimental effect was all that could be desired, and without any great support in the New York market, the day following the railroad magnate's death resulted in a semi-bear panic, rather than in a slaughter of bulls as many believed would occur. Prices were also affected by the fact that Union Pacific was heavily purchased by two different factions who wished to secure voting privileges.

Mr. Harriman's illness and death have so absorbed attention this week, that the unfavorable changes in money and crop conditions have received only small consideration. The indicated corn crop for 1909 is below the average of the preceding five years. This is not favorable when we consider that our crops should gradually increase with population. Wheat, corn and cotton all show declines when compared with the crops of 1906. Oats is the only crop showing an increase.

The general revival in business continues, and there is also talk of a car shortage this fall. Stock prices, however, have discounted many of the good things we are now beginning to see. It is also probable that any excited speculation in stocks, such as took place last month, would result in a considerable raising of money rates.

The unfavorable aspect of the Copper Producers', report, which shows an increase in stocks of more than 12,000,000 lb. was received with some disfavor. As a result, copper shares have been heavy all week.

Boston, Sept. 14—Mining-share prices received quite a set-back last week, but quick recoveries have followed. The report of the Copper Producers' Association showing a large increase in the visible supply of the metal for August contributed, with

the sharp break in Amalgamated, to cause a weak day Thursday. Calumet & Hecla has reduced its asking price from 13¾ to 13½c., but this was passed by in the stock market.

Again, the action of the Calumet & Hecla affiliated companies turned sentiment for the better. The fact of the matter is very few mining stocks are pressing for sale, while, on the other hand, there is no demand. Allouez had a good sharp spurt to $57.50. It has sold as low as $51.50. Copper costs at the Allouez are low, and it is said below the price at which Calumet & Hecla can produce. Centennial, after a $4.62½ break to $39.50, recovered to $43 today.

There has been little news to affect mining shares one way or the other. Developments in the Lake Superior district may bring favorable news at any time. Lake advanced from $32.50 to $36, and closed at about the highest. Isle Royale has been active; the extreme price variation during the week was from $23.87½ to $26. U. S. Smelting has been an active feature with both weak and strong days.

Amalgamated, after a $5.50 slump to $77.50, is back to $80.50. A considerable short interest is said to exist in this specialty. La Salle had a sharp spurt to $15.75 today.

Curb trading was characterized by heaviness in Davis-Daly and First National, which have now recovered. Rhode Island Coal holds above 11, which is the supporting point. Vulture has held strong close to $8.50.

STOCK QUOTATIONS

NEW YORK Sept. 15	
Name of Comp.	Clg.
Alaska Mine	‡.11
Amalgamated	80¾
Anaconda	47⅜
Balaklala	‡2⅛
British Col. Cop.	6¼
Buffalo Mines	3⅛
Butte Coalition	24¾
Colonial Silver	⅞
Cum. Ely Mining	7¼
Davis-Daly	5⅛
Dominion Cop.	7
Douglas Copper	1¼
El Rayo	3
Florence	3
Foster Cobalt	‡.32
Furnace Creek	‡.05
Giroux	8¾
Gold Hill	⅛
Goldfield Con.	6¾
Granby	99
Greene Gold	‡⅛
Greene G. & S.	‡9
Guanajuato	1¾
Guggen. Exp.	218
Hanapah	‡15
Kerr Lake	8¼
McKinley-Dar.	.89
Miami Copper	15⅜
Micmac	⅛
Mines Co. of Am.	⅛
Montezu. of C. R.	23½
Mont. Sho. C.	2¼
Nev. Utah M. & S.	1¾
Newhouse M. & S.	3
Nipissing Mines	10⅝
Old Hundred	½
Silver Queen	.40
Stewart	7/16
Tennessee Cop'r.	35⅝
Tri-Bullion	⅝
United Copper	10¾
Utah Apex	4⅝
Utah Copper	49
Yukon Gold	5 7/16

‡Last quotation.

BOSTON Sept. 15	
Name of Comp.	Clg.
Adventure	6
Allouez	58
Am. Zinc	‡31¼
Arcadian	4½
Arizona Com.	43⅜
Atlantic	10¾
Boston Con.	14¾
Calumet & Ariz.	104
Calumet & Hecla	670
Centennial	42
Copper Range	80¾
Daly-West	8½
East Butte	11
Franklin	16½
Greene—Can.	9
Hancock	9½
Isle Royal	25¾
Keweenaw	3⅝
La Salle	15½
Mass	8½
Michigan	10½
Mohawk	61½
Nevada	24
North Butte	57¼
Ojibway	9
Old Colony	.60
Old Dominion	.54½
Osceola	146
Parrot	32
Quincy	90
Rhode Island	‡4¾
Shannon	15⅞
Superior	59
Superior & Bost.	16
Superior & Pitts.	15¾
Tamarack	‡65
Trinity	13
U. S. Smg. & Ref.	54⅞
U.S.Sm. & Re., pd.	52
Utah Con.	44¼
Victoria	3¾
Winona	6
Wolverine	151
Wyandotte	2¼

‡Last quotation.

N. Y. INDUSTRIAL	
Am. Agri. Chem.	48
Am. Smelt. & Ref.	97½
Am.Sm. & Ref., pf.	111¾
Colo. Fuel & Iron	43¼
Federal M. & S., pf.	‡91½
National Lead	90¼
National Lead, pf.	‡112
Pittsburg Coal	22⅞
Republic I. & S.	38½
Republic I. & S., pf.	106
Sloss-Sheffield	85⅛
Standard Oil	‡685
U. S. Steel	79¼
U. S. Steel, pf.	125¼
Va. Car. Chem.	47

BOSTON CURB	Low.
Ahmeek	215
Chemung	16½
Chino	7¾
Globe Con.	‡4½
Gila	9⅜
Mason Valley	2
Ray Central	2½
Ray Con.	18⅝
San Antonio	8¾
Yuma	2

Furnished by Hornblower & Weeks, N. Y.

ST. LOUIS Sept. 11		
N. of Com.	High.	Low.
Adams	.40	30
Am. Nettie	.09	.07
Center Cr'k	1.75	1.50
Cent. C. & C.	85.00	84.00
C.C. & C. pf.	84.00	83.00
Cent. Oil	110.00	100.00
Columbia	9.00	7.00
Con. Coal	20 00	19 00
Doe Run	115.00	100.00
Gra. Bimet.	.30	.25
St. Joe	12.50	11.00

LONDON Sept. 15			
Name of Com.	Clg.		
Dolores	£1	5s	0d
Stratton'sInd.	0	3	3
Camp Bird	1	8	3
Esperanza	2	19	0
Tomboy	1	1	3
El Oro	1	5	6
Oroville	0	12	6

Cabled through Wm. P. Bonbright & Co., N. Y.

NEVADA STOCKS. Sept. 15.
Furnished by Weir Bros. & Co., New York.

Name of Comp.	Clg.
COMSTOCK STOCKS	
Belcher	.91
Best & Belcher	.61
Caledonia	.35
Challar	.26
Comstock	.28
Con. Cal. & Va.	1.42
Crown Point	1.20
Exchequer	.33
Gould & Curry	.27
Hale & Norcross	.43
Mexican	1.27
Ophir	1.30
Overman	.46
Potosi	58
Savage	52
Sierra Nevada	50
Union	54
Utah	09
Yellow Jacket	1 27
TONOPAH STOCKS	
Belmont	72
Extension	58
Golden Anchor	...
Jim Butler	12
MacNamara	.29
Midway	.18
Montana	1 02
North Star	.02
Tono'h Mine of N.	6.76
West End Con.	.27
GOLDFI'D STOCKS	
Adams	.01
Atlanta	.14
Blue Bell	03
Booth	.12
C.O.D. Con.	.08
Columbia Mt.	.10
Comb. Frac.	.77
Con. Red Top	...
Cracker Jack	.02
Dia'dfield B. B. C.	.01
Goldfield Belmont	.04
Goldfield Daisy	.16
Great Bend	.06
Jumbo Extension	.16
Kendall	.02
Lone Star	.03
May Queen	.04
Oro	.06
Red Hill	.06
Sandstorm	.06

Name of Comp.	Clg.
Silver Pick	.14
St. Ives	.05
Triangle	.01
BULLFROG STOCKS	
Gibraltar	.02
Homestake King.	...
Mont. Shoshone C.	1.87½
Tramp Cons.	.04
MISCELLANEOUS	
Cumberland Ely.	7.00
Giroux	8.87½
Greenwa'r Copper	.03
Nevada Con.	23.87½
Nevada Hills	.70
Navada Smelting	.87½
Nevada Wonder	.70
Nevada-Utah	1.68¾
Penn-Wyoming	...
Pittsburgh S. Pk.	.50
Ray Central	2.27½
Ray Con.	18.75
Round Mt. Sphinx	.05

COLO. SPRINGS Sept. 10

Name of Comp.	Clg.
Acacia	.07⅞
C. C. Con.	‡.03⅜
Dante	‡.07
Doctor	.09½
Elkton	.74⅝
El Paso	.65
Findlay	.11¾
Gold Dollar	‡.13¾
Gold Sovereign	.04½
Isabella	.21½
Jack Pot	‡.08½
Jennie Sample	.08
Jerry Johnson	‡.06¼
Lexington	‡.01¾
Mary McKinney	‡ 47
Pharmacist	.03½
Portland	.84
U. G. M.	.08
Vindicator	.71
Work	07½

Assessments

Company.	Delinq.	Sale.	Amt.
Alta Gladstone, Utah	Sept. 15	Oct. 20	$0.00½
Andes, Nev.	Sept. 14	Oct. 5	0.10
Arcadian, Mich.	Sept. 1	Sept. 31	0.50
Boulder Cr'k M. & M., Wash.	Aug. 31	Sept. 30	0.01
Copper Mt. M. & D., Ida.	Sept. 7	Oct. 4	0 003
Crown Point, Nev.	Aug. 21	Sept. 17	0 10
East Buffalo, Ida.	Sept. 10	Oct. 10	0.000½
Hancock Con., Mich.	Oct. 10		1 00
Hypotheek, M. & M., Ida.	Aug. 26	Sept. 25	0 005
Laclede, Ltd, Ida.	Aug. 23	Sept. 21	0.003
Lady Washington, Nev.	Aug. 31	Sept. 20	0.05
Massasoit, Utah	Aug. 21	Sept. 14	0.00½
Mexican, Nev.	Sept. 10	Oct. 4	0.10
New Hope, Ida.	July 15	Sept. 25	0.002
Overman, Nev.	Sept. 8	Sept. 29	0.05
Pittsburg Con., Utah	Aug. 20	Sept. 17	0.01
So. Columbus Con., Utah	Sept. 13	Oct. 5	0.05
Springfield M. Co. Ltd, Ida.	Aug. 13	Sept. 13	0.002
West Century M. & M., Utah	Aug. 31	Sept. 17	0.01
Winona Mich.	Sept. 14		1.00
Zenoli Silver Copper, Utah	Sept. 10	Sept. 27	0.01

Monthly Average Prices of Metals

SILVER

Month.	New York.		London.	
	1908.	1909.	1908.	1909.
January	55.678	51.750	25.738	23.834
February	56.000	51.472	25.855	23.706
March	55.365	50.468	25.570	23.227
April	55.505	51.428	25.133	23.708
May	52.795	52.905	24.377	24.343
June	53.663	52.538	24.760	24.166
July	53.115	51.043	24.514	23.519
August	51.683	51.125	23.858	23.588
September	51.720	.....	23.877	.....
October	51.431	.....	23.725	.....
November	49.647	.....	22.933	.....
December	48.766	.....	22.493	.....
Total	52.864	.....	24.402	...

New York, cents per fine ounce; London, pence per standard ounce.

COPPER

	NEW YORK.				LONDON.	
	Electrolytic		Lake.			
	1908.	1909.	1908.	1909.	1908.	1909.
January	13.726	13.893	13.901	14.280	62.386	57.688
February	12.905	12.949	13.098	13.295	58.786	61.198
March	12.704	12.387	12.875	12.826	58.761	56.231
April	12.743	12.56½	12.928	12.93½	58.331	57.363
May	12.598	12.893	12.788	13.238	57.387	59.338
June	12.675	13.214	12.877	13.548	57.842	59.627
July	12.702	12.880	12.933	13.363	57.989	58.556
August	13.462	13.007	13.639	13.296	60.500	59.393
September	13.388	.....	13.600	.....	60.338	.....
October	13.354	.....	13.646	.....	60.139	.....
November	14.130	.....	14.386	.....	63.417	.....
December	14.111	.....	14.411	.....	62.943	.....
Year	13.208	.....	13.424	.....	59.902	...

New York, cents per pound. Electrolytic is for cakes, ingots or wirebars. London, pounds sterling, per long ton, standard copper.

TIN AT NEW YORK

Month.	1908.	1909.	Month.	1908.	1909
January	27.380	28.060	July	29.207	29.125
February	28.978	28.290	August	29.942	29.966
March	30.577	28.727	September	28.815	.....
April	31.702	29.445	October	29.444	.....
May	30.015	29.225	November	30.348	.....
June	28.024	29 322	December	29.154	....
			Av. Year.	29.465	..

Prices are in cents per pound.

LEAD

Month.	New York.		St. Louis	London.	
	1908.	1909.	1909.	1908.	1909.
January	3.691	4.175	4.025	14.469	13.113
February	3.725	4.018	3.868	14.250	13.313
March	3.838	3.986	3.835	13.975	13.438
April	3.993	4.168	4.051	13.469	13.297
May	4.253	4.287	4.214	12.938	13.225
June	4.466	4.350	4.291	12.600	13.031
July	4.744	4.321	4.188	13.000	12.563
August	4.580	4.363	4.227	13.375	12.475
September	4.515	.....	.....	13.125	...
October	4.351	.....	.....	13.375	.....
November	4.330	.....	.....	13.538	.....
December	4.213	.....	.....	13.156	..
Year	4.200	.....	.....	13.439	.....

New York and St. Louis, cents per pound. London, pounds sterling per long ton.

SPELTER

Month.	New York		St. Louis.		London.	
	1908.	1909.	1908.	1909.	1908.	1909.
January	4.513	5.141	4.363	4.991	20.563	21.425
February	4.788	4.889	4.638	4.739	20.875	21.563
March	4.665	4.757	4.527	4.607	21.075	21.438
April	4.645	4.965	4.495	4.815	21.344	21.531
May	4.608	5.124	4.458	4.974	19.906	21.975
June	4.543	5.402	4.393	5.252	19.000	22.000
July	4.485	5.402	4.338	5.252	19.031	21.969
August	4.702	5.729	4.556	5.579	19.350	22.125
September	4.769	.....	4.619	.....	19.563	...
October	4.801	.....	4.651	.....	19.750	....
November	5.059	.....	4.909	.....	20.875	.....
December	5.137	.....	4.987	.....	20.625	..
Year	4.726	.....	4.578	.....	20.163	..

New York and St. Louis, cents per pound. London, pounds sterling per long ton.